COMMONWEALTH AGRICULTURAL BUREAUX

THIRTY-FIRST ANNUAL REPORT

OF THE EXECUTIVE COUNCIL

1959-60

INCLUDING NOTES OF PROGRESS
IN THE AGRICULTURAL SCIENCES

LONDON: HER MAJESTY'S STATIONERY OFFICE

FIVE SHILLINGS NET

COMMONWEALTH AGRICULTURAL BUREAUX
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(31st March, 1960)

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COMMONWEALTH AGRICULTURAL BUREAUX

Thirty-first Annual Report

of the Executive Council

1959-60

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1960

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PREFACE

The Imperial Agricultural Research Conference, 1927, stressed (*a*) the need for scientists to be in touch with the progress of research throughout the world in their several branches, and (*b*) the difficulty therein owing to the great output of scientific literature and the diversity of languages in which it is published.

It recommended the governments of the British Commonwealth to establish on a joint co-operative basis eight bureaux to collect, collate and disseminate information on research in eight selected branches of agricultural science, and generally to assist research workers in the Commonwealth and Empire with information relevant to their subjects. Each bureau was to be located at a research institute specialising in its own branch of science so that the bureau officers should be in daily contact with men engaged on research in its own subject. These bureaux were to be financed from a common fund contributed by Commonwealth governments in agreed proportions and controlled by a Council composed of representatives of those governments on an equal footing.

Governments accepted these proposals. In November, 1928, a new type of inter-imperial co-operative agency acceptable to all governments was worked out in detail. On 1st April, 1929, the Executive Council of the Imperial Agricultural Bureaux came into being. The eight bureaux started work in that year. From 1st January, 1948, the name of the organisation was changed to Commonwealth Agricultural Bureaux.

Following the Ottawa Conference of 1932, the work of several inter-imperial agencies was examined and reported upon by the Imperial Committee on Economic Consultation and Co-operation (1933). This committee approved of the bureaux organisation and of its work, and extended the duties of the Council, inter alia, proposing that with effect from 1st October, 1933, they should also be responsible for the supervision and administration and finance of the Imperial Institute of Entomology and of the Imperial Mycological Institute.

It also enunciated certain general principles to be observed in regard to the organisation of agencies for inter-imperial co-operation and consultation, e.g., constitutional equality of participating governments in the appointment of the authority administering the work; the provision of adequate finance for a definite period of years; careful and periodical examination of the work and organisation of the agency at the Commonwealth conferences suitable for the purpose, as without that assurance governments could hardly be expected to provide the adequate continuing finance; and the responsibility of the administering authority to all participating governments. All governments accepted this report.

The British Commonwealth Scientific Conference (1936) conducted the first of these "periodical examinations". It approved both the work and organisation. It recommended the finance necessary until 1941-42 (extended later to cover the war period), its distribution between governments, also the formation of two more bureaux, and certain modifications in practice designed to improve general efficiency. Governments accepted these proposals.

A Review Conference was held in the summer of 1946, just one year after the close of the war. This was the first since 1936 and was only the second "periodical examination" since the recommendations of the Imperial Committee on Economic Consultation and Co-operation in 1933. The Review Conference, 1946, recommended that the Parasite Service should continue to be located at Belleville, Canada, that it should become an individual bureau and that its name should be changed to the Bureau (now Institute) of Biological Control to denote its separate entity. It also recommended that information on general husbandry should be provided within the framework of the existing bureaux which, in turn, necessitated the name of the Bureau of Pastures and Forage Crops being altered to Pastures and Field Crops. Both changes of name were made on 1st April, 1947, the opening date of the period to which the recommendations of the conference referred. It recommended the finance necessary until 1951-52 and its distribution between governments. Governments accepted these proposals.

The third periodical examination took place in June and July, 1950. With such a well-established organisation as this had now become, the conference was naturally concerned more with consolidation than with new developments. It did, however, lay stress on the need to continue the service; the mutual advantage of co-operation with international bodies, especially to avoid duplication of work; the possibility of foreign governments being associated with C.A.B.; and the desirability of extending the services of the Institute of Biological Control to foreign countries. It also approved the use of Farnham House for the accommodation of Headquarters and Central Sales, advised the formation of the Consultant Directors into a Scientific Advisory

Committee, approved the handing over of the Potato Collection to the Agricultural Research Council of the United Kingdom and provided funds to set up a new Bureau of Agricultural Economics though, for various reasons, the setting up of this bureau was deferred.

A further Review Conference was held in London in the summer of 1955. A section of the report deals with action on the recommendations of this conference but it is worthwhile recording here the opening recommendation:

"(1) The Conference is firmly persuaded, as a result of the inspections and discussions which have taken place during its progress, that the Commonwealth Agricultural Bureaux Organisation provides an information service on scientific work in agriculture and forestry throughout the world which is of vital importance for agricultural development and thus for the production of food and the maintenance of living standards; that such a comprehensive service is not provided anywhere else and could not be provided by either national or international organisations so cheaply or so efficiently; and that the cost of the service is very small in relation to the value of agricultural and forestry production in the contributing countries.

"The Conference has endeavoured to frame recommendations which will not only ensure the full and efficient maintenance of existing services and provide for some measure of expansion, but will also leave the door open for further enlargement of the field of activities at a later date."

The 1955 Review Conference went on to endorse certain recommendations of the 1950 Conference, particularly in regard to co-operation with international bodies and association of foreign governments with the work of the Commonwealth Agricultural Bureaux, and to modify others in the light of experience gained. The Conference suggested changing the name of the Bureau of Agricultural Parasitology (Helminthology) to Helminthology, of the Bureau of Dairy Science to Dairy Science and Technology and of the Bureau of Soil Science to Soils. It advocated increased superannuation benefits for C.A.B. staff, improved salaries for Assistant Directors, provision for taxonomic and identification services in helminthology and coverage of literature on weed control. It deferred action on matters like the proposed Bureau of Agricultural Economics and the establishment of a laboratory of the Institute of Biological Control in East Africa but recommended a grant towards the journal of The National Institute of Agricultural Engineering pending a decision on the proposed Bureau of Agricultural Engineering at the next Conference. Finally, it recommended the finance needed till 1961-62 but called for a re-examination of the allocation of units of contribution to the C.A.B. Organisation.

A further Review Conference is to be held in the autumn of 1960.

The institutes and bureaux act as effective clearing houses of information for scientists and research workers in agriculture and forestry throughout the Commonwealth and, increasingly, throughout the world.

To do this they collect information by scanning and indexing as far as possible all journals in their subjects in all languages, by scanning other abstracts, and by keeping in touch with research in progress. They distribute this information by the periodical issue of 15 abstract and three other journals, by the frequent issue of monographs reviewing some particular subject within their field and by various other publications.

Apart from the printed record, the institutes and bureaux serve as intelligence centres in a variety of other ways. They may answer individual enquiries, an activity that ranges from supplying a few references to furnishing a bibliography, a basic library list, or a memorandum of digested information. Several bureaux may co-operate in this, particularly where information marginal to their interest is concerned. They may also supply reprints, photo-reproductions or microfilms of material inaccessible to an enquirer. They also assist research workers by giving information about research centres, by arranging meetings between workers in different parts of the Commonwealth, by arranging the exchange of experimental material between workers, by giving information on post-graduate study, on the sources of supply of apparatus and equipment, and so on. It is stressed that any scientist is free to send enquiries straight to the Director concerned. The institutes have the important additional duty of identification each in its own field.

The Institute of Entomology maintains no collection of its own, as its work is integrated very closely with the British Museum, but the Mycological Institute keeps its own working herbarium which now contains some 80,000 specimens. It also maintains the United Kingdom national collection of type cultures for all fungi except medical fungi, timber rotting fungi and yeasts.

The Institute of Biological Control prepares and maintains a catalogue of the parasites and predators of the insects of the world. Part 5 of Section 2 is the last published. The principal activity of this institute is, however, in the practical field. It consists mainly of the supply of beneficial insects attacking various pests. This requires field survey collections and sometimes mass breeding and the

development of special methods of shipment. There are stations in Europe, India, Pakistan, West Indies and the United States. In addition to the supply of parasite material, the institute takes complete charge of biological control projects for governments. The institute also carries out research and educational work.

A brief summary of the work carried out at the institutes and bureaux during the year under review is given on pages 15-27.

The organisations under the administration of the Executive Council are:

The Commonwealth Institute of Entomology

The Commonwealth Mycological Institute

The Commonwealth Institute of Biological Control

The Commonwealth Bureaux of:
- Animal Breeding and Genetics
- Animal Health
- Animal Nutrition
- Dairy Science and Technology
- Forestry
- Helminthology
- Horticulture and Plantation Crops
- Pastures and Field Crops
- Plant Breeding and Genetics
- Soils

A 'liaison' officer appointed by the appropriate department of each participating country keeps in touch with administrative matters, and in each country for each bureau a scientific officer is nominated as Official Correspondent to be the 'general friend' on scientific matters of that bureau in that country. A few bureaux also nominate Foreign Correspondents who are really the equivalent of Official Correspondents in foreign countries. The Secretary and each director also has an opposite number named in F.A.O. with whom he corresponds directly. The heads of the several institutes at which bureaux are located act as Consultant Directors of the bureaux, thus giving the Council and bureaux the benefit of their wide experience and scientific knowledge. Together they constitute the Scientific Advisory Committee. All other officers are whole-time servants of the Executive Council.

REPORT

At its meeting on the 29th June, 1960, the Executive Council of the Commonwealth Agricultural Bureaux adopted the following report on its 31st year of work—1st April, 1959, to 31st March, 1960.

This is the third financial year of the review period 1957-58 to 1961-62.

GENERAL NEWS

2. *Review Conference.* Arrangements were being made to hold the next Review Conference in London during the autumn of 1960. The Headquarters staff has endeavoured to cope with this extra work without any addition to its numbers but it is not really geared for it.

3. *Council meetings.* These were held as usual at Africa House and at Farnham House and also at the London headquarters of the Agricultural Research Council in Regent Street and at the Bureau of Animal Breeding and Genetics, Edinburgh. The Executive Council had eight meetings during the year under report besides the annual conferences with the Scientific Advisory Committee and with the Directors.

4. A special meeting was called on 6th January, 1960, to record formally certain conclusions reached by Council on the retirement of Sir Herbert Howard from the Secretaryship of C.A.B. on the 31st December, 1960, and to appoint a successor just before the Review Conference.

5. *Recognitions and awards.* Mr. W. Ness, C.A.B. Liaison Officer for the United Kingdom, was awarded a C.B.E. in the Birthday Honours, 1959.

Mr. G. W. Nye, Liaison Officer for the Colonial Territories, was awarded a Knighthood in the New Year Honours, 1960.

6. Dr. J. M. Watson, Director, Bureau of Helminthology, acted as external examiner for the degree of Doctor of Philosophy of the Faculty of Science, University of Cairo. He supplied information on the qualifications of applicants for post-graduate fellowships, grants, posts, etc., to the Civil Service Commissioners, Government of Ghana, University of London, and to the Government of Iraq.

The taxonomist at the bureau, Mr. W. M. Fitzsimmons, was awarded the Fellowship of the Royal College of Veterinary Surgeons for a thesis entitled "The Oxyuroid Parasites of some South African Reptiles".

The Director of the Bureau of Plant Breeding and Genetics, Dr. P. S. Hudson, was elected Chairman of the Library Committee of the Faculty Board of Agriculture.

7. *Appreciations.* In an article entitled La documentazione agricola in Gran Bretagna e nel Commonwealth, Dr. L. Quagliotti wrote, "There is in fact today no agricultural research worker of any nationality whatever who, wishing to keep abreast of the scientific problems that interest him, does not normally consult the bibliographical journals of the Commonwealth Agricultural Bureaux and moreover does not have the satisfaction of seeing his own experimental contributions referred to there".

The Director of the Dairy Technology Research Institute, Research Branch, Canada Department of Agriculture, recently wrote with reference to the list of journals abstracted in *Dairy Science Abstracts*, "I must say that perusal of the list of periodicals must impress everyone with the completeness with which your organization covers the literature. This, with the excellence of the individual abstracts, makes this *the* most important publication for dairy research workers." The total circulation of this journal exceeded 2,000 for the first time.

The Centralized Title Service of the Forestry Bureau which now has 42 Commonwealth and 62 Foreign subscribers, is proving of interest to other bureaux. Apart from the solid evidence of its popularity afforded by a steady year-to-year growth, individual appreciations are received from time to time of this "wonderful service" and of these "very wonderful and complete cards"—of which 799,000 were despatched during the year, 43 per cent. by air.

In addition, the Chief Forestry Bibliographer in Austria, Professor Dr. Frauendorfer, in a recent article cited the Centralized Title Service as an instance of a card service supplementing an abstract service and probably constituting an ideal compromise solution of the problem of keeping scientists properly informed.

The changes made in the format and issue schedule of *Helminthological Abstracts* have been favourably commented upon by several leading helminthologists and senior officials of the United Kingdom Ministry of Agriculture, Fisheries & Food.

Many standard scientific works are making increasing use of *Plant Breeding Abstracts* as sources of literature. Thus in an article on breeding egg plant (*Solanum Melongena* L.) by L. Quagliotti in Sementi elette 1959: *5*: 38-45, in a bibliography of 78 titles 51 were derived from *Plant Breeding Abstracts*. The bibliographies in the large German Handbuch der Pflanzenzüchtung cite many works particularly those in Russian and Japanese by reference to *Plant Breeding Abstracts*. Countries

behind the Iron Curtain do the same. Thus a Polish article on cereal breeding published in Postepy Nauk Rolniczych 1959, No. 3, was one of a number of Polish articles that cited references from *Plant Breeding Abstracts*.

8. *Bibliographies*. There has been a continuous demand for annotated bibliographies from the Bureau of Soils, of which 300 have now been prepared, dealing with every aspect of soil and fertilizer science. Although the great majority are supplied free, receipts from sales of additional bibliographies amounted to over £340 during the year, as compared with £150 in the previous year. This service appears to be highly appreciated and one which is becoming more effective and easier to operate as the number of cards indexed by the three-year-old classification system of the bureau increases. This system is proving very efficient in retrieving all kinds of information from the card index. The classification is not perfect, and the bureau has expressed its appreciation of the frequent help provided by the experts at Rothamsted in locating further sources of information. This same help has also provided evidence of the potential value, still not fully realized, of the service of the bureau.

Some of the remarks about the Bureau of Soils during the year may be worth reporting: "I am most grateful to you for this courtesy and promptness. Your Bureau certainly does provide an expeditious service"—S. Rhodesia. "I cannot help but repeat again how much I appreciate the various services of your bureau"—Israel. "These (bibliographies) are excellent, and the bureau needs a great commendation for this monumental work"—Iraq. "Very many thanks indeed for yet another batch of most useful bibliographies"—United Kingdom. "Our library would like to have a standing order for these bibliographies which have proved most useful"—Holland. "Thank you for the bibliographies and the splendid services of the bureau"—Australia. "Thank you very much for the bibliography . . . I am quite astonished at the speed at which you have produced it"—United Kingdom. The last citation referred to a request for an annotated bibliography on fluorescence microscopy in the study of soil organisms. A bibliography of 25 papers emanating from eight different countries was prepared and despatched within 24 hours of the receipt of the request.

9. *Accommodation*. Negotiations were proceeding for the provision of a separate laboratory for the West Indian Station of the Institute of Biological Control at present accommodated at the Imperial College of Tropical Agriculture, Trinidad.

The present quarters of the Bureau of Animal Breeding and Genetics are no longer adequate but the bureau expects to be accommodated in the new headquarters contemplated for the Animal Breeding Research Organisation which may provide for a joint library.

Increasing staff resulted in overcrowding at the Forestry Bureau. This may be relieved by the autumn of 1960 by the completion of a fourth storey to the Imperial Forestry Institute.

There was also some overcrowding at the Soils Bureau.

Elsewhere, accommodation was just about sufficient for the existing bureau staff.

10. *Biological Control*. Co-operation with the United States Department of Agriculture and the Citrus Experiment Station, California, continued to expand. Some of their staff have visited the Stations of the Institute and three minor projects have been carried out (at the European, Indian, and West Indian Stations) for the United States Department of Agriculture. Arrangements are being made for financing several projects, of interest to Commonwealth countries as well as to the U.S.A., at both the Indian and Pakistan Stations, with funds available under U.S. Public Law 480. This refers to money obtained in various countries from the sale of commodities by the United States for which dollar payment was not required. Such funds, in this case in rupees, are being utilized by the United States partly in 'aid' and partly to finance work from which the U.S.A. itself may derive some benefit. The projects under consideration by the Institute deal with insect and weed pests of interest to Pakistan, India, Canada, Australia, New Zealand, and East Africa. The Director was invited to address a meeting held in Washington, 5th-7th February, 1960, concerning the application of biological control methods to insects of medical importance. This meeting was held under the auspices of the American Institute of Biological Sciences. It was impossible to attend the meeting, but a paper was submitted and read, and it was hoped that some developments in this field might result.

A request was also received from the Food and Agriculture Organisation about the widespread tropical forestry pests *Hypsipyla* spp.

11. *Journals*. The strike in the printing industry during the summer of 1959 disrupted the abstract journal routine, but by the use of improvised methods production was soon back to normal. One part of the *Review of Applied Mycology* was produced by the photo-offset method at the Mycological Institute. Two parts of the *Review of Applied Entomology* (*Series A and B*) and one number of *Dairy Science Abstracts* were produced by the photo-offset method by the Reprinting Unit, Central Sales.

12. *Special publications.* A book describing the techniques and methods employed at the Mycological Institute, including a concise, factual history of its founding and development, by Dr. Wiltshire, was in the final stages of preparation at the end of March, 1960. It is hoped to publish it in July.

A Review of the Biological Control of Insects & Weeds in Australia and Australian New Guinea, by Mr. F. Wilson, C.S.I.R.O., Australia, was published soon after the close of the year. It is hoped that similar surveys will follow for other parts of the Commonwealth to fulfil a long-felt demand for a Commonwealth survey which had been recommended by the 1950 Review Conference.

13. *Copyright.* The U.S.S.R. is not a signatory to the international copyright convention and the Soviet royalty law specifically excludes foreigners. Authors from the rest of the world therefore have no claim for royalties when their books are either translated or reprinted in the Soviet Union and, it is believed, even when exported in cheap editions.

14. *Information Services.* The issue of newsletters as an additional source of information to their Official Correspondents and others is becoming common practice in some of the bureaux; some are also compiling directories of research stations and installing photocopying machines to meet the demand for original articles. The Bureau of Horticulture and Plantation Crops started an experimental translation service in October, 1959.

Notes on enquiries made and information supplied are included in the directors' summaries of their annual reports, but a few are mentioned below.

The Institute of Entomology completed the checking on a very long list of insect names required for a textbook of Indian entomology, and on another list for a forthcoming publication, "Agriculture and Land Use in Ghana". Information on the control of certain insects was supplied to the U.S.S.R. through the Director-General, European Plant Protection Organisation.

Some of the telephone enquiries that reach the Institute of Entomology reflect more the urgency of the requests than their simplicity. A film studio, for instance, asked what crepuscular sounds could be heard on a summer's eve on the edge of a forest in New Zealand!

The bacteriologist at the Mycological Institute has at the request of the West African Cocoa Research Institute, Ghana, undertaken a special project to assist in the identification of the causal agent of cushion gall of cacao, which is at present unknown.

A request from a research worker in Canada for references to the genetic aspects of response to drugs elicited a bibliography of 59 references from the Bureau of Animal Breeding and Genetics, mainly dealing with hormones. The bureau supplied a research worker at Makerere College, Uganda, with another bibliography of 81 references on the effects of age and methods of storage on egg hatchability and, in acknowledging this, the enquirer said he had no idea that so much had been published on this subject. The Indian Council of Agricultural Research asked for information on the crossbreeding of sheep in the tropics and on the use of imported (European) breeds in the tropics. The Council also asked for references and information on the use of Indian breeds of cattle and buffalo in other countries.

The Bureau of Animal Health had three enquiries for information about selenium. In the past the only veterinary interest in this metallic element was in its toxicity. In some parts of the world, notably South Dakota, Colorado, Nebraska, Wyoming and also certain restricted areas in the south of Ireland, the soil and herbage have an unusually high selenium content. In these areas serious losses have occurred in grazing stock. Selenium disulphide was also used in preparations for treating dogs suffering from certain forms of dermatitis.

However, in recent years there has been evidence that selenium may be an essential element for some species of domestic animals and that a deficiency of it in the diet may be related to certain disease conditions of obscure aetiology. These diseases are muscular dystrophy (white muscle disease) in cattle and sheep: "hogget ill-thrift" of young sheep in New Zealand; hepatosis dietetica (big liver disease) of pigs; and exudative diathesis in chickens. Recently it has been suggested that a deficiency of selenium may be involved in the unexplained heavy losses which have occurred from time to time in sheep after they have been dosed with carbon tetrachloride for the treatment of liver-fluke disease.

These findings have aroused considerable interest. While there is no question that selenium is a highly toxic substance for livestock there are some indications that it may have prophylactic and even therapeutic effects in certain diseases. Before it can come into general use considerably more study will be required into its action and its safety both for animals to which it may be administered and to man who may eat the flesh, milk or eggs from treated animals.

The breeding of chinchillas for their valuable fur is becoming quite an industry in some parts of the world and in recent years considerable numbers of them have been imported into Great Britain and Northern Ireland.

Apparently losses from disease have been fairly common and the Bureaux of Animal Health and Animal Breeding and Genetics had several requests for information on this subject. Unfortunately published work on the diseases of the chinchilla is

not very abundant and much of it is rather scrappy; most of it, so far, comes from American journals.

A rather unusual enquiry came from Fiji. The Bureau of Animal Health was asked to advise whether the importation of onions from Spain and Holland might involve any risk of importation of foot and mouth disease.

The answer was that there was little likelihood of onions being contaminated with the virus of foot and mouth disease, even when grown in countries where the disease existed. Onions from foot and mouth disease-infected countries have been imported into Great Britain for many years and have never been incriminated as a source of infection. However, packing materials, such as straw, could well be contaminated. In Great Britain regulations require that such packing materials from infected countries must not be used for feeding or bedding livestock.

As Fiji is a country in which foot and mouth disease has never occurred and as its geographical position isolates it very effectively from infected countries, it was suggested that it might be prudent for Fiji to take even more stringent precautions than those in force in Great Britain. Although the risk involved in importing onions would be very small, it might be wise not to accept even a small risk.

A sketch of equipment used in Paraguay for home milling of cassava was provided by the Bureau of Animal Nutrition, with the help of the Director of the Institute of Nutrition of Central America and Panama in Guatemala, for an enquirer from Northern Rhodesia.

The Indian Council of Agricultural Research asked the Bureau of Dairy Science and Technology (and the Bureau of Animal Breeding and Genetics) for details of any studies on the effect of music on the milk yield of cows and buffaloes, while the Indian Association for the Cultivation of Science was given details of a new British process of milk preservation using ultrasonic waves.

One enquiry from Canada regarding the organization of sub-professional forestry schools in various countries of the world successfully invoked the services of no less than 14 foreign correspondents of the Forestry Bureau. The Assistant Forest Geneticist, Silvicultural Research Division, Lahore, Pakistan, was put in touch with eight specialists dealing with similar problems elsewhere in the world and wrote that he was "very much impressed".

In response to requests from several different quarters, the Bureau of Helminthology is conducting a kingdom-wide investigation of the incidence of hydatid disease in domestic animals and man with a view, *inter alia*, to promoting the introduction of regulations governing the resale of infected offal for pet food. The bureau is at present co-operating in the investigation of a rare form of malignant human disease hitherto considered to be of unknown aetiology, but which may prove to be a zoonosis of nematode origin.

The Bureau of Plant Breeding and Genetics extracted details from Japanese articles dealing with genetics and cytology for workers at the University of London and the University of Manitoba.

RECOMMENDATIONS OF THE 1955 REVIEW CONFERENCE

15. The action taken on the recommendations of the Commonwealth Agricultural Bureaux Review Conference, 1955, up to approximately the end of the year 1959/60, are fully reported in C.A.B./R.C./1960/1. The paper will have been supplied to all Members of Council, Liaison Officers, Delegates to the Conference, etc., and will be reproduced in full as Appendix I to the Report of the proceedings of that Conference. As repetition would take up a disproportionate amount of space in this annual report, the recommendations and action taken thereon are not mentioned here.

MEMBERSHIP OF THE EXECUTIVE COUNCIL

16. Mr. A. Perera, member for Ceylon, succeeded Dr. J. G. Malloch, Canada, as Chairman of the Executive Council, and Mr. C. K. Reheem, member for Pakistan, succeeded Mr. Perera as Vice-Chairman, with effect from the 180th Council meeting on 7th October, 1959.

Mr. J. F. Brooks became full member of Council for the Union of South Africa. During his absence on furlough, Mr. O. J. la Grange deputised.

Mr. W. W. K. Vanderpuye was nominated in July, 1959, as Council member for Ghana in place of Mr. J. E. Sagoe.

LIAISON OFFICERS

17. In December, 1959, Dr. S. J. du Plessis of the Department of Agricultural Technical Services was nominated Liaison Officer for the Union of South Africa in place of Dr. P. D. Henning.

STAFF CHANGES

18. *Consultant Directors.* Dr. A. T. R. Mattick, on his retirement from the Acting Directorship of the National Institute for Research in Dairying, also ceased to be the Consultant Director of the Bureau of Dairy Science and Technology, and Professor R. G. Baskett was appointed Consultant Director in his place in October, 1959.

Professor M. V. Laurie became Consultant Director of the Forestry Bureau in October, 1959, when Sir Harry Champion retired.

Directors. Mr. G. K. Argles succeeded Mr. D. Akenhead as Director, Bureau of Horticulture and Plantation Crops, on 1st April, 1959.

Dr. I. Leitch retired on 13th February, 1960, and was succeeded by Dr. D. Harvey. Dr. Leitch was reappointed on a part-time basis for special duties.

Assistant Directors. Mr. G. E. Tidbury, Scientific Assistant, was appointed Assistant Director, Bureau of Horticulture & Plantation Crops, from 15th July, 1959, in place of Mr. Argles, and Dr. D. L. Duncan was appointed Assistant Director, Bureau of Animal Nutrition from 13th February, 1960, in place of Dr. Harvey.

Mr. P. W. Swire was appointed Assistant Director, Bureau of Animal Breeding & Genetics, from 2nd November, 1959, in place of Mr. R. H. Gethin who had resigned earlier in the year.

VISITS OVERSEAS

19. Mr. E. O. Pearson, Director, Institute of Entomology, visited the Federation of Rhodesia and Nyasaland to advise on cotton-pest problems in April-May, 1959, and spent a few days in Uganda on the return journey.

At the invitation of the Government of Canada, Dr. J. C. F. Hopkins, Director, Mycological Institute, made a tour of the principal research centres of the Canada Department of Agriculture after attending the International Botanical Congress. At each centre he delivered a lecture, illustrated by transparencies, to departmental and university research staff on the services provided by the Institute, and promoted discussion on publications, particularly the *Review of Applied Mycology*.

Dr. F. J. Simmonds, Director, Institute of Biological Control, was on tour from 6th May to 8th November, 1959, in Pakistan, India, Ceylon, Federation of Malaya, New Guinea, Australia, New Zealand, Fiji, Hawaii and California. This tour enabled him to visit some of the outlying stations of the Institute and to discuss biological control problems with a number of entomologists. He then started another long tour in Africa, from 10th March, 1960.

Mr. A. G. G. Hill, Director, Bureau of Pastures and Field Crops, visited the following Commonwealth countries during the period 2nd November, 1959, to 10th February, 1960: Malta, Uganda, Kenya, Zanzibar, Tanganyika, Federation of Rhodesia and Nyasaland, the High Commission Territories of Bechuanaland, Basutoland and Swaziland, and the Union of South Africa.

ATTENDANCE AT CONFERENCES AND COMMITTEES

20. The Secretary, Sir Herbert Howard, was on the Continent in May, 1959. He attended the Ist World Congress of Agricultural Research in Rome from 7th to 9th May and renewed contacts with F.A.O., he saw Dr. von Frauendorfer in Vienna about the financing of the *World Agricultural and and Rural Sociology Abstracts* and, on his return journey, visited Unesco and had a discussion with Professor Boutry in Paris on the steps being taken by the I.C.S.U. Abstracting Board for international co-operation in abstracting in the biological sciences.

The meeting of the Inter-African Phytosanitary Commission held in London from 26th-30th October, 1959, was attended by Mr. E. O. Pearson, Director, Institute of Entomology, and Mr. G. S. Cotterell.

Dr. W. J. Hall and Mr. E. O. Pearson served as members of the Committee for Colonial Agricultural, Animal Health and Forestry Research and the Colonial Pesticides Research Committee, Dr. Hall being Chairman of the latter until 31st October, 1959; Mr. Pearson also served as a member of the British Standards Institution Technical Committee on the Nomenclature of Pesticides, the Advisory Committee on Anti-Locust Research, the Scientific Advisory Committee of the Empire Cotton Growing Corporation, and the Council of the Royal Entomological Society of London, of which he was nominated a Vice-President.

Mr. G. J. Kerrich served as President of the Society for British Entomology, Treasurer of the Systematics Association and a member of Council of the British Trust for Entomology.

Mr. W. H. Potts served as a member of the Tsetse Fly and Trypanosomiasis Committee, and as Editor of the Royal Entomological Society of London.

Dr. J. C. F. Hopkins, Director, Mycological Institute, and Mr. E. W. Mason attended the IXth International Botanical Congress, Montreal. The former also attended the annual meeting of the Inter-African Phytosanitary Commission in London and continued to serve on the Colonial Agricultural Research Committee, Colonial Pesticides Research Committee, British Standards Institution Pesticide Committee, London Advisory Committee for Rubber Research, and the Medical Mycology Committee of the Medical Research Council.

Major H. A. Dade also continued as a member of the Stored Products Sub-Committee of the Colonial Agricultural Research Committee.

Dr. G. C. Ainsworth accepted an invitation to serve on the Expert Advisory Panel in Parasitic Diseases of the World Health Organisation.

Mr. Deighton was appointed at the IXth International Botanical Congress at Montreal in 1959 to the Nomenclature Committee for Fungi and Lichenes, as representative of Great Britain.

Dr. V. P. Rao, Entomologist-in-Charge, Indian Station, Institute of Biological Control, attended the Food and Agriculture Rice Production and Protection Conference at Peredeniya, Ceylon, in December, 1959, and gave a paper "Natural enemies of rice and stem-borers and allied species in various parts of the world and possibilities of their use in biological control of rice stem-borers in Asia".

Mr. M. Crawford, Director, Bureau of Animal Health, attended the XVth International Dairy Congress in London, from the 29th June to the 3rd July, 1959, and a Symposium at the Institute of Biology on "Biological problems arising from the control of pests and diseases", on 1st and 2nd October, 1959, at which he read a paper on "Biological problems arising from the control of diseases of livestock".

Mr. R. Mack, Assistant Director, attended the XVIth International Veterinary Congress at Madrid, 21st to 27th May, 1959.

Mr. E. J. Mann, Director, Bureau of Dairy Science and Technology, continued to serve on one of the organizing committees for the XVth International Dairy Congress which was held in London in June-July, 1959, and which he attended in company with his Assistant Director, Mr. J. M. Davies, and one of the Scientific Assistants.

Mr. Mann continued to serve as a member of a Committee of the International Dairy Federation dealing with dairy terminology. Meetings of this Committee took place in Kiel and in Shinfield during the year.

Mr. Mann delivered a lecture, in German, on "The development and present position of the market milk industry in Great Britain" at the annual meeting of the Verband Grosstädtischer Milchversorgungsbetriebe at Nuremberg in May, 1959.

Mr. F. C. Ford Robertson, Director, Forestry Bureau, attended a meeting of the joint FAO/IUFRO Committee on Bibliography at Lourizan and Madrid, from 14th to 21st September, 1959. In company with Sir Herbert Howard, he also attended a conference on Biological Abstracting in Monte Carlo on 22nd and 23rd December, 1959. Mr. Ford Robertson served on the Standing Committee on British Commonwealth Forestry, the Forestry Working Group of the FAO National Committee and the Planning Committee of the Empire Forestry Association. The Bureau of Helminthology continued to collaborate with W.H.O. in respect of helminthic diseases of man, and the Director continued to serve as a member of the Expert Advisory Panel for Parasitic Diseases at Geneva.

The inaugural meeting of the International Society for Horticultural Science in Paris on 27th April, 1959, was attended by Mr. Argles, Director of the Bureau of Horticulture and Plantation Crops.

Mr. A. G. G. Hill, Director, Bureau of Pastures and Field Crops, attended meetings of the organizing committees of the VIIIth International Grassland Congress, 1960.

Dr. P. S. Hudson, Bureau of Plant Breeding and Genetics, attended a Symposium on the results of agricultural research held by the Plant Breeding Section of the German Society of Agriculture in Stuttgart-Hohenheim on 25th to 27th June, 1959, and delivered a paper in German on Russian research in plant breeding.

VISITS TO INSTITUTES AND BUREAUX BY OVERSEAS SCIENTISTS

21. The Official Correspondents of the Bureau of Dairy Science and Technology in Australia and Southern Rhodesia visited the bureau during the year.

The Official Correspondents of the Forestry Bureau in Kenya, North Borneo, Sarawak, Tanganyika, Trinidad and the Republic of the Sudan attended a special Land Use course at Oxford in July, 1959, and also took the opportunity of visiting the bureau.

Something of bureau work was explained to senior forestry officers of the Overseas Service attending a meeting at the Imperial Forestry Institute in August, 1959, and to four Norwegian forest officers in March, 1960.

Pressure of work prevented any formal documentation courses from being held at the Forestry Bureau but a special 3-day course was put on for Mr. M. A. H. Siddiqui, travelling on a Unesco fellowship from Pakistan, and special documentary assistance was given to Mr. Daly, a forest officer proceeding from Nigeria to Hong Kong.

Arrangements were in train for giving a special course to Mrs. Rowinski, Library Branch of the Canada Department of Northern Affairs and National Resources, Ottawa.

An interesting visitor was Capt. E. M. Hassan of the Pakistan Army Veterinary Corps who had come to the United Kingdom to deliver three polo ponies presented to Her Majesty the Queen.

Other distinguished visitors included:

Professor C. C. Allison, U.S.A.; Professor J. G. Baer, Switzerland; Dr. R. E. Balch, Forest Biology Service, Canada; Dr. E. E. Chamberlain, New Zealand; Professor T. W. Dwight, University of Toronto; Dr. R. Fournier, Inter-African Bureau for Soils and Rural Economy, Paris; Dr. E. L. French, Australia; Dr. D. L. Gunn, Ceylon; Professor W. K. Hirschfeld, Netherlands; Professor P. Hoekstra, Netherlands; Professor F. B. Hutt, U.S.A.; Dr. G. A. Ledingham, Canada; Mr. G. Lloyd, Minister of Education, U.K.; Dr. Marek, Poland; Mr. R. M. Moore, Division of Plant Industry, C.S.I.R.O., Canberra; Dr. K. O. Müller, Germany; Mr. P. H. Nye, University College of Ghana; Dr. R. F. Peterson, Canada; Mr. A. L. Poole, Assistant Director of Forestry, New Zealand; Professor A. S. Radov, U.S.S.R.; Dr. E. W. Russell, East African Agriculture and Forestry Research Organization, Kenya; Dr. R. I. Sailer, Insect Identification and Parasite Introduction, Research Branch, U.S.D.A.; Dr. H. P. R. Seeliger, Germany; Dr. S. A. Sher, U.S.A.; Dr. D. F. Steward, Australia; Mr. C. Swabey, Forestry Adviser to the Colonial Office, Colonial Office; the Hon. R. J. M. Swynnerton, Kenya; Professor Iwar Tasaki, Nagoya University, Japan; Mr. L. W. Tiller, Assistant Secretary, D.S.I.R., New Zealand; Dr. J. A. White, United States Overseas Mission, Liberia; Dr. F. Whiting of the Program Directorate, Research Branch, Canada.

PUBLICATIONS

22. The receipts from sales of publications have always been collected separately by the institutes for their respective publications, and by the Bureau of Animal Nutrition for the journal *Nutrition Abstracts and Reviews*. Central Sales deals with the sales of publications for headquarters, for all the other bureaux and for the Occasional Publications of the Bureau of Animal Nutrition. The four sets of cash have always been shown separately in annual reports.

23. In addition, in reports before 1953-54, the cash receipts of Central Sales were analysed for headquarters and for each bureau. This analysis entailed a considerable amount of work and some thought its value was doubtful as it did not represent the value of sales made during the year. Council therefore decided that, as from the 1st April, 1953, this cash analysis should be discontinued and the receipts of Central Sales during the financial year should be shown as a block total, the figure for 1959-60 being £50,967 as against the 1958-59 figure of £47,005 (see paragraph 24). Council also thought that instead of the cash analysis a record of invoices sent out during the year should be made showing the value of the actual sales made during the year.

From paragraph 26 it will be seen that the figure for 1959-60 is £52,510 as against the 1958-59 figure of £46,551.

24. Receipts from sales of publications over the last seven years have been as follows:

	1953–54	1954–55	1955–56	1956–57	1957–58	1958–59	1959–60
	£	£	£	£	£	£	£
Commonwealth Institute of Entomology	10,210	10,334	11,433	15,582	14,144	14,630	14,801
Commonwealth Mycological Institute	7,367	6,833	6,820	9,438	10,781	11,471	11,770
Nutrition Abstracts and Reviews	7,031	6,972	8,428	9,928	9,582	11,856	11,967
The Bureaux	27,100	30,252	31,041	40,868	45,018	47,005	50,967
TOTAL	51,708	54,391	57,722	75,816	79,525	84,962	89,505

NOTE: The prices of journals were raised for the 1957 volumes.

Expenditure on production of publications for the bureaux (excluding *Nutrition Abstracts and Reviews* and the Institutes) amounted to £41,223 during the year as against £33,182 for the preceding year. Cash collected during the year was £50,967, thus giving a surplus of £9,744 of revenue over expenditure. This surplus and the rise in revenue of £3,962 resulted from an increase in subscriptions

to the abstract journals and a continuing demand for the back volumes of those journals. It must be repeated that these calculations are for the publications dealt with by Central Sales and do not include the figures for *Nutrition Abstracts and Reviews* nor the publications of the Institutes.

25. *Reprinting Unit.* This unit was established at Farnham House during 1957, reference paragraph 21 of the 29th Annual Report. The unit uses Xerography (an electrical reproduction process for making paper and metal offset duplicating masters) and offset litho equipment. During the year five parts of the 1959 volumes of the abstract journals, three occasional publications and several reports totalling 850 pages were printed from typescript prepared by the Institutes and Bureaux. In addition approximately 9,200 pages of back volumes of journals and other publications have been reprinted.

26. The sales analysis, that is, the analysis of the actual invoices sent out during the year, referred to in paragraph 23 above, is shown in the table below. For comparison, figures are given for seven years. Only the publications dealt with by Central Sales have been shown in this way and earlier figures are intended to show the general trend.

	Sales Analysis						
	1953–54	1954–55	1955–56	1956–57	1957–58	1958–59	1959–60
	£	£	£	£	£	£	£
Animal Breeding and Genetics	2,661	2,934	2,625	3,145	3,706	4,795	4,551
Animal Health	4,161	5,014	5,781	6,963	8,108	8,126	9,159
Animal Nutrition	83	51	41	628	513	288	436
Dairy Science and Technology	2,101	2,388	2,727	5,107	3,972	5,431	5,938
Forestry	2,442	2,939	3,274	5,180	5,087	5,913	5,667
Helminthology	1,540	1,621	1,866	2,266	3,174	2,765	4,491
Horticulture and Plantation Crops	3,729	3,343	3,541	4,686	5,036	5,138	5,357
Pastures and Field Crops	3,033	4,083	3,916	4,787	4,830	4,573	5,158
Plant Breeding and Genetics	2,911	2,929	3,718	4,320	4,242	4,224	5,378
Soils	2,822	3,648	4,005	4,683	5,468	5,183	6,099
Headquarters	184	106	88	329	258	115	276
TOTAL	25,667	29,056	31,582	42,094	44,394	46,551	52,510

The increases and decreases from year to year in the sales of publications of the individual bureaux are largely due to the incidence of the issue of occasional publications. If a bureau issues two or three occasional publications during one year and none the following year there will be a slight decrease in sales unless there has been a very large increase in subscriptions to its abstract journal.

27. The above table relates to sales and takes no account of copies distributed under the quota system or free. Under the quota system copies of the 1959 volumes of the journals to the value of £9,043 were sent to countries of the Commonwealth and other contributing countries. In addition, journals to the value of £1,590 were sent free and as exchange to Commonwealth countries and to the value of £3,275 to foreign countries.

The total value of copies distributed under the quota, free and exchange was £13,908.

Corresponding figures for 1958 were quota, £8,742, free and exchange to Commonwealth countries, £2,458 and to foreign countries £3,317; total value £14,517.

In paragraph 24 it is said that receipts from sales during the year showed an excess over the direct costs of printing, distribution and paper, but if the very great value of these various free copies is added to the receipts the total comes to far more than the direct cost of production.

28. In addition a further 102 volumes of *Agricultural and Horticultural Engineering Abstracts* and 159 copies of *World Agricultural Economics and Rural Sociology Abstracts* were distributed under the quota system by arrangement with the publishers.

29. The numbers on the mailing lists for the 1959 volumes of all journals were as follows:

	Volumes supplied under quota system	Other volumes supplied free	Sub-scriptions	Total
British Commonwealth, the Republic of the Sudan and the Republic of Ireland	2,739	467	6,696	9,902
Other countries	—	990	11,623	12,613
TOTAL	2,739	1,457	18,319	22,515

30. The subscriptions to the *Bulletin of Entomological Research* and the fourteen abstract journals only, detailed in paragraph 32, increased in number during the year from 16,408 to 17,412. This is analysed in the following table:

Agency	1958	1959	Increase or Decrease		Percentage Increase
			Plus	Minus	
Institute of Entomology (3 journals)	3,310	3,317	7	—	0.2
Mycological Institute (1 journal)	1,496	1,448	—	48	Decrease
Nutrition Abstracts and Reviews (1 journal)	1,709	1,784	75	—	4.3
Bureaux (10 journals only)	9,893	10,863	970	—	9.8
TOTALS	16,408	17,412	1,004		6.1

The decrease of 48 in subscriptions to the *Review of Applied Mycology* was due to 49 subscriptions not being received until after the close of the 1959 volume year on 31st December, 1959.

31. Action taken to increase the sales of journals and occasional publications was as follows:

(i) Central Sales now distributes twice a year a *Publications List of the Commonwealth Agricultural Bureaux* to selected addresses. Some 6,000 of the April, 1959, list were despatched and 6,000 of the October list. Leaflets describing new Occasional Publications and cyclostyled forms showing recent publications were inserted in the journals in considerable numbers. Interested people were given specimen copies of journals, and, in some cases, extra copies of certain parts of journals were printed to be circulated to potential purchasers.

(ii) Publications were shown in book exhibitions organised by scientific organisations or associations of booksellers. During the year C.A.B. publications were displayed at book exhibitions in London, Leipzig, Washington, Tokyo, Madrid, and New York.

(iii) C.A.B. publications were also brought to the notice of scientists and the public generally by advertisements either paid for or exchanged with other scientific journals.

(iv) The annual report is sold and is also widely distributed free, thus permitting many persons to acquaint themselves with the work of C.A.B. if they so desire.

32. During 1959 the following volumes of the *Bulletin of Entomological Research* and the fourteen abstract journals were issued:

Bulletin of Entomological Research, Vol. 50
Review of Applied Entomology, Series A, Vol. 47
Review of Applied Entomology, Series B, Vol. 47
Review of Applied Mycology, Vol. 38
Nutrition Abstracts and Reviews, Vol. 29
Animal Breeding Abstracts, Vol. 27
Veterinary Bulletin, Vol. 29
Dairy Science Abstracts, Vol. 21
Forestry Abstracts, Vol. 20
Helminthological Abstracts (see next paragraph)
Horticultural Abstracts, Vol. 29
Herbage Abstracts, Vol. 29
Field Crop Abstracts, Vol. 12
Plant Breeding Abstracts, Vol. 29
Soils and Fertilizers, Vol. 22

The publication year of all the above journals is the calendar year and the first part or parts of the 1960 volumes were issued by the 31st March, 1960, the end of the year under review. With *Helminthological Abstracts*, the present arrangement by which the literature published in each year is brought into a single volume when bound, will terminate with the completion of volume 27 (1958). Volume 28 is a composite production. Part 1 contained abstracts of such literature published in 1959 as came to hand before September of that year; parts 2, 3, 4 and 5 will contain titles (without abstracts) of all helminthological books and articles which came to the attention of the Bureau after the completion of the relevant annual volume under the old scheme since its inception; and part 6 will contain the title page and annual indices. From Volume 29, which will be issued during 1960, each volume of *Helminthological Abstracts* will be issued in four quarterly parts appearing in March, June, September and December. Each part will include abstracts of all papers which come to hand during the relevant period of preparation, regardless of their date of publication, and will be provided with author indices only. The title page, author and subject indices covering each volume will be issued in March of the following year.

33. Other periodical publications issued during the year were:

Distribution Maps of Insect Pests, Nos. 97-108	*Entomology*
Distribution Maps of Plant Diseases, Nos. 364-373 and Index for 1959	*Mycology*

Commonwealth Phytopathological News, Vol. 5, Parts 2-4 and Vol. 6, Part 1	*Mycology*
Bibliography of Systematic Mycology for 1958	*Mycology*
Review of Medical and Veterinary Mycology, Vol. 3, Parts 6-9	*Mycology*
Catalogue of the Culture Collection (2nd Edition) Supplements 5 and 6	*Mycology*
Index Veterinarius Vol. 26, (1958), Parts 3 and 4, Vol. 27 (1959), Parts 1 and 2	*Animal Health*
Veterinary Reviews and Annotations Vol. 5	*Animal Health*

34. The following occasional publications were issued during the year:

Mycological Papers, Nos. 71-75	*Mycology*
Fungal Diseases of Animals, by G. C. Ainsworth and P. K. C. Austwick	*Animal Health*
Diet in Relation to Reproduction and Viability of the Young, Part 2. Sheep: World Survey of Reproduction and	
Review of Feeding Experiments, by W. Thomson and F. C. Aitken	*Animal Nutrition*
The Nematode Parasites of Plants Catalogued under their Hosts (Supplement only), by J. B. Goodey and Mary T. Franklin	*Helminthology*
Plants Recorded as Resistant to Root - Knot Nematodes (*Meloidogyne* spp.), by Mary T. Franklin and D. J. Hooper	*Helminthology*
Mist Propagation of Cuttings, by Patricia Rowe-Dutton	*Horticulture and Plantation Crops*
Minor Elements and their Effects on the Growth and Chemical Composition of Herbage Plants, by R. Dorrington Williams	*Pastures and Field Crops*
Grazing Control: Laws and Regulations in various countries for the Control of Grazing to Prevent Injury to Grasslands, by A. G. G. Hill	*Pastures and Field Crops*
Bracken: A Review of the Literature, by K. W. Braid	*Pastures and Field Crops*
Relations Between Water and Soil, by T. J. Marshall	*Soils*

SUMMARIES OF THE ANNUAL REPORTS FOR 1959-60, BY DIRECTORS

COMMONWEALTH INSTITUTE OF ENTOMOLOGY

35. The opening of the year was clouded by the death of Sir Guy Marshall, K.C.M.G., D.Sc., F.R.S., Director of the Institute from its foundation in 1913 until 1942, and ever since then a part-time member of the staff. It was in 1909 that he was appointed as Scientific Secretary of the Colonial Office's Entomological Research Committee, from which this Institute stemmed, thus beginning an association that was to last for half a century. He remained actively at work, continuing to deal with all the weevils received by the Institute for identification, until only a few weeks before his death, on 8th April, at the age of 87.

During the year, three taxonomists have been appointed to the staff: Mr. R. W. Crosskey (Diptera), Dr. M. S. K. Ghauri (Hemiptera) and Dr. B. J. Selman (Coleoptera).

36. The number of specimens received for identification during the year was abnormally high, at approximately 90,500, but the excess over the previous year (when 54,500 were received) was largely accounted for by a single consignment from Belgian Congo consisting of very long series of relatively few species. The number of consignments was 535, slightly fewer than previous year (555), sent in by 248 (235) correspondents, 83 (84) of whom were working in Africa, 23 (17) in America, 59 (46) in Asia, 26 (20) in Australasia and Oceania and 57 (69) in Europe. The 401 (466) lists of identifications sent out comprised 7,551 (6,948) names, and the total of species identified included 3,732 (3,889) from Africa, 235 (119) from America, 2,098 (1,322) from Asia, 1,193 (1,040) from Australasia and Oceania and 293 (578) from Europe; the territories from which the material was obtained included almost all member countries of the Commonwealth. As usual, most specimens were returned to the senders, but 6,152 (8,885) were presented to the British Museum, including the types of 109 (202) species and specimens of 307 (196) species hitherto unrepresented in the Museum collection.

37. Twenty papers representing the results of taxonomic and ecological studies were published by members of the staff in scientific journals, and in all comprised 378 printed pages.

38. The Director visited the Federation of Rhodesia and Nyasaland in April-May, 1959 in connection with research in progress on cotton pests, and spent a few days in Uganda on the return journey.

39. *The Review of Applied Entomology*, Series A and B, Vol. 47 (1959) totalled 720 pages (exclusive of indexes) and contained 1,464 abstracts and titles, the corresponding figures for 1958 being 732 and 1,453. Prompt publication was maintained despite the prolonged printing dispute, the July and August numbers being produced, in collaboration with Head Office, by a combination of varitype and xerographic reproduction, and closely approximating in appearance to the normal issues. The special arrangements made for overcoming arrears of indexing are bearing fruit; during the year the indexes to Vols. 44 Series A (101 pp.), 45 Series A (111 pp.) and Series B (53 pp.) and 46 Series B (49 pp.) were issued and the compilation of the index to Vol. 46 Series A was completed.

40. The *Bulletin of Entomological Research* Vol. 50 (1959) comprised 58 papers, of which 43 were contributed from entomologists working overseas, and totalled 824 pages (exclusive of index) and 19 plates. The four parts were issued in March, August and November 1959 and January, 1960, Part 2 having been delayed by the printing dispute. The index is in press.

Twelve issues (Nos. 87-108) were made in the series of *Distribution Maps of Insect Pests*, six in each of June and December, 1959.

41. There was a slight net increase in the number of subscribers to publications, the figures (with those of 1958 in brackets) being: *Review of Applied Entomology* Series A, 1,336 (1,331) and Series B, 1,036 (1,039); *Bulletin of Entomological Research*, 945 (940); *Distribution Maps of Insect Pests*, 336 (316). Sales of back numbers of these serial publications, though less than in 1958, nevertheless remained high, at £2,115. The continued demand for back numbers of the *Review* and *Bulletin* is a satisfactory feature; several complete sets of each were sold, and some of the scarcer issues are now being reprinted xerographically. A total of 769 copies of Occasional Publications were sold, and sales of Busvine's *Critical Review of the Techniques for Testing Insecticides* have now exceeded one thousand.

42. The proportion of the receipts from sales of the *Zoological Record*, part *Insecta*, received by the Institute under agreement with the Zoological Society of London, amounted to £741 (£676), to which must be added the Society's contribution of £400 towards the cost of production. Vol. 94 (literature of 1957), comprising 576 pages, the largest ever to have been published, and providing a guide to the subject matter, and a complete record of the systematic content, of 3,877 entomological papers, was issued in August, 1959. Vol. 95 (literature of 1958) is in the press.

43. The total net cash receipts from all sales of publications in the year ended 31st March, 1960 amounted to £14,801, as compared with £14,630 in the previous year.

44. Library accessions during the year numbered 236 volumes and 1,741 pamphlets, making a total of 14,479 volumes and 48,804 pamphlets now in the library. Parts of 695 serial publications were also received of which 434 were from non-Commonwealth sources. The author catalogue is up-to-date for monographs and now fairly complete for separates; 70·2 per cent. of the whole library is now catalogued on cards by authors, but the high rate of new accessions makes it difficult to increase this figure. The subject index to monographs, comprising 2,290 cards, and the sheaf catalogue of serial and official publications are both up to date.

The library was in daily use by both staff and visitors, and the number of loans made rose slightly, to 1,582. Various subject and bibliographical enquiries were received and dealt with from government departments, universities, research departments and commercial firms, as well as individual readers. Microfilms or photocopies of 68 articles and extracts were obtained for correspondents in 8 Commonwealth and 3 foreign countries. Surplus publications were distributed to the Bureaux and various other institutions. As always, grateful thanks are due to individuals and organisations who donated publications to the library, especially to those who supplied missing parts that helped to complete sets of periodicals.

45. A wide range of enquiries was received on entomological subjects other than those concerning insects submitted for identification. Among the more time-consuming were lengthy lists of names for nomenclatorial checking in connection with publications in India and in Ghana, and among the more challenging were citrus fruit (from Dominica) and decaying grass (from Patagonia) which had evidently long been separated from the putative cause of their visible condition; most, of course, were on traditional lines and sought information on the biology of particular pests and the most recent developments in their control, but one of these concerned the use of ultrasonic waves in pest control and another came from the U.S.S.R., through the European Plant Protection Organisation. Two enquiries which had to be channelled elsewhere were concerned fully as much with presentation as with data: one sought 'candid' photographs of developmental stages of about twenty tropical agricultural pests; the other, though

less demanding in the number of insect subjects, required them on cinematograph film in colour and preferably with sound. Finally, one may note that telephone enquiries reaching the Institute sometimes reflect the urgency with which a reply is needed rather than any simplicity of the request. One such, from a studio, asked what crepuscular sounds may be heard on a summer evening on the edge of a forest in New Zealand. Less rare, and offering an even wider choice of reply, is a laconic request for the name of 'the moth' that attacks some staple crop of mankind.

46. The Institute continued to assist the Inter-African Phyto-Sanitary Commission in the compilation and revision of lists of insect pests likely to concern African countries, and with specific enquiries concerning necessary quarantine precautions. Monsieur M. H. Barat, formerly Chef du Service des Recherches appliquées à la Protection des Végétaux, Madagascar, has succeeded Dr. J. Risbec as Scientific Secretary of the Commission, whose headquarters are at the Institute.

47. Mr. E. S. Brown, of the Colonial Pool of Entomologists, continued on secondment to the Foreign Office for work on the soun pest, *Eurygaster integriceps*, and has transferred his headquarters from Beirut to Teheran. Mr. C. R. Wallace returned from St. Helena, where he had been conducting a survey of the insect pests, and completed a comprehensive report on his assignment. Dr. I. W. B. Nye spent the past year in the Seychelles, where he has assessed the results of measures for the control of the coconut pest *Melittomma insulare*, initiated an improved treatment utilising a creosote/coal-tar mixture, supervised the re-treatment of the entire coconut-palm population on the island of Praslin and initiated an extension of the method to the main island of Mahé.

48. Two members of the Colonial Termite Research Unit, Mr. W. V. Harris and Mr. R. M. C. Williams, were attached to the Institute during the year. Mr. Williams left for duty in British Honduras in March. Mr. W. A. Sands has returned from Nigeria on the conclusion of the Unit's activities in West Africa.

Identifications were made of 89 species of termites in 218 samples, originating in East Africa, Northern Rhodesia, West Africa, Ethiopia, Sudan, St. Helena, Saudi Arabia, Persia, India, Malaya, Indonesia, Dutch New Guinea, Costa Rica and Surinam. Over 5,000 specimens have been added to the British Museum collection, either collected by the Unit or obtained for identification or by exchange.

Colonies of living termites continue to be maintained. Material of *Zootermopsis* has been supplied to a number of University laboratories as living colonies, or as a source of protozoa. Material of three species was supplied to the Pest Infestation Laboratory, for tests with methyl bromide.

Mr. Harris represented the Institute at a meeting of a British Standards Institution committee on the testing of wood preservatives against insect attack, and subsequently prepared a memorandum on laboratory tests with termites.

A wide variety of economic enquiries were dealt with, mainly on the question of termite proofing. Reports were made on two cases of termite damage to cotton goods in transit.

Six papers, comprising 75 printed pages, dealing with the taxonomy and biology of termites were published by members of the Unit during the year.

49. It is a pleasure to record the Institute's thanks to Sir Gavin de Beer, the Director of the British Museum (Natural History), and to Dr. W. E. China, the Keeper of Entomology, for the facilities accorded to the members of the staff of the Institute who work in the Museum, and to acknowledge the continued close and friendly co-operation of the staff of the Department of Entomology.

COMMONWEALTH MYCOLOGICAL INSTITUTE

50. *General.* An event of major significance for the Institute was the retirement of the senior mycologist, Mr. E. W. Mason, in February, 1960, after 40 years' service. All Commonwealth plant pathologists and mycologists owe him a great debt of gratitude for his life's work pioneering a route through the labyrinth of the taxonomy of microfungi.

Dr. M. B. Ellis has now taken charge of the Herbarium.

Rather less than the usual number of visitors have worked in the Herbarium. They came from Great Britain, Holland, Malaya (3 months), Northern Rhodesia, and South Africa.

Mr. R. W. Rayner continued to write up the results of his researches on coffee in Kenya during the whole year, under a special Colonial Development and Welfare Research Fund scheme.

A second annual Students' Day was held which was well attended. Visits were also paid by parties from Imperial College, London, the Brunel College of Technology, the Distillers Coy. Ltd. (Research Division), the National College of Food Technology, and St. Maur's Convent School, as well as by

Colombo Plan and Nigerian students. The Director gave an illustrated talk on plant pathology to each party, and also participated again in the post-graduate seminar on 'Science in the New Commonwealth Countries' at the Institute of Commonwealth Studies, University of London.

The grounds of the New Building have been finally laid out and planted with lawns and suitable perennials. The grounds of the Old Building have also been cleared and replanted and the lawns renovated.

51. *Library.* With the appointment of an additional and fully trained assistant librarian much progress has been made under the direction of Dr. Ainsworth in realigning the stacks and re-cataloguing. The new arrangement allows for (i) a reading room section for staff and visitors housing the most used books and journals and the library catalogues, and all abstracting journals have been grouped in near proximity; (ii) a geographical section where the distribution maps of plant diseases can be conveniently prepared; and (iii) an indexing section where the annual indexes for the two *Reviews* are compiled.

A key to the subject arrangements of the books has been incorporated into a general subject index, in strip index form, which has not hitherto existed, and a re-check made of the distribution of reference books held in the Herbarium, Culture Collection, and the *Review* Reference Room. The existing geographical arrangement of the journals, and its index, have also been revised.

For the first time conference reports have been grouped and fully catalogued and a key to the subject arrangement incorporated into the general subject index in strip index form.

Large arrears of binding have been made up, but much still remains to be done.

The following additions were made during the year: 170 books, 32 journals, 1,448 reprints, 241 microfilms.

There are now 2,746 papers on microfilm held in stock.

Library loans amounted to 200.

52. *The Review of Applied Mycology.* The printing dispute temporarily disrupted the routine of the abstract journals. In order to overcome delay in printing, part 8 of Vol. 38 was produced in its entirety on the photo-offset plant at the Institute. A good deal of improvisation was necessary to accomplish this as all the work of collating, trimming, and stapling had to be done by hand, no machines being available. There was, however, no change in page size so that part 8 can be bound without modification into the complete volume. Further space has been saved by the introduction of additional abbreviations and modifications of the annual index. A leaflet giving the principal abbreviations currently used in the *Review* was distributed with the January number.

53. *Review of Medical and Veterinary Mycology.* Vol. 3, parts 6 to 9, were issued and the supplement of literature up to 1956 and index to Vol. 2 (1953-57) was finally published in December. Seven of the eight published parts of the current volume have already been indexed.

The facilities afforded for making regular visits to the library of the Brompton Hospital and the Royal College of Veterinary Surgeons are greatly appreciated.

54. *Index of Fungi.* Mr. Deighton, with the assistance of Mr. Sutton, continues to compile this periodical, which has again increased in size. This is an indication of the increasing number of mycologists in the world. Entries of names omitted from Petrak's lists now number about 4,000 and a supplementary list is being prepared for publication in the 1960/61 year.

55. *Commonwealth Phytopathological News.* This quarterly has now become established as a link between English-speaking plant pathologists and is also read quite extensively by agricultural and administrative officers. The number of subscribers still remains disappointingly small and it is not self-supporting as it should be. Individual subscribers do not take advantage of the low price of *5s.* a year, but rely solely on official library copies (one of which may serve 50 people). The question of an increased subscription will need to be considered at the Commonwealth Mycological Conference 1960.

56. *Identification Service.* Some 3,818 specimens (3,798 in 1958/9), bringing the total accessions in Herb I.M.I. to 79,921, were received from the following Commonwealth countries: Australia, Bechuanaland Protectorate, Borneo (282), British Guiana, British Solomon Islands (273), Canada, Ceylon, Cyprus, Federation of Malaya, Federation of Rhodesia and Nyasaland (112), Fiji, Gambia, Ghana, Hong Kong, India (145), Jamaica (243), Kenya (115), Mauritius (99) New Zealand, Nigeria (82), Pakistan (72), Papua and New Guinea (66), Sarawak (103), Seychelles, Sierra Leone, South Africa (51), Southern Cameroons, Tanganyika, Trinidad, Uganda, United Kingdom and Zanzibar.

Identifications were also made of specimens from Belgian Congo, Brazil, Egypt, France, Israel, Lebanon, The Netherlands, Netherlands New Guinea, New Caledonia, Republic of the Sudan, Thailand, Turkey and United States of America.

Named specimens have been sent to the Herbarium by Dr. Savile (Ottawa), Professor Savulescu

(Roumania) and Dr. Vasudeva (India). Very useful large collections of unnamed specimens were received from A. Johnston (F.A.O., Bankok).

Important records include *Chloridium musae* and *Piricularia musae* on banana in British Cameroons; *Cladosporium colocasiae* on *Colocasia* in North Borneo, Sarawak and Mauritius; *Cercospora fuliginea* causing a brown leaf mould of tomato, *Elsinoe fawcettii* on citrus, *Cercospora koepkei* and *Glomerella tucumanensis* on sugarcane in British Solomon Islands; *Mycosphaerella musicola* on banana in Mauritius.

Dr. Ellis continued revisionary studies on the Hyphomycetes and undertook a major share of the identification work.

Mr. Deighton continued his studies of *Cercospora* and allied genera and of West African fungi generally. He checked lists of fungi for Ghana and the names of rusts in a list for Pakistan.

Miss Waterhouse continued to deal with the Phycomycetes, in particular *Phytophthora*, *Pythium* and *Peronospora*. Specimens received numbered 85. She gave assistance to the staff of the West African Cocoa Research Institute, Ghana, in the determination of strains of *Phytophthora palmivora* attacking cacao. She also spent much of her time on editorial duties connected with the *Review of Applied Mycology*, compiled and edited the *Bibliography of Systematic Mycology* 1958 and gave assistance in the revision of the titles of publications scanned for the *Review* and to the British Mycological Society in compiling the new edition of Common British Plant Diseases.

Dr. Booth undertook general identification of Ascomycetes and continued revisionary work on genera of the Hypocreales, with a special study of conidial states of *Nectria*, *Calonectria* and *Gibberella*. Many of these conidial states are *Fusarium* spp. and Dr. Booth is specializing in this genus with a view to undertaking direct identification in the near future.

Dr. Ainsworth continued to do smut identifications as well as his normal editorial duties.

Mr. Sutton was appointed in August, 1959 and is engaged in general identification work and a revision of *Coryneum*.

Mr. Laundon was appointed in October, 1959 and is engaged on general identification work, especially the Uredinales and Basidiomycetes.

Mr. Pirozynski was appointed in March, 1960 and is doing general identification work and making a preliminary investigation into the genus *Cephaleuros*.

Nearly a hundred histological slides of the parasitic states of fungi pathogenic for higher animals and man in host tissues have been incorporated in the Herbarium.

57. *Literature*. Dr. Ellis has prepared a paper on the genus *Acarocybe*, a new genus *Acarocybella*, 9 species of *Pithomyces*, and 10 of *Corynespora* for publication in 1960.

Mr. Deighton published *Mycological Paper* No. 71, Studies in *Cercospora* and allied genera I, in May, 1959, and has No. 78, African Fungi (4 new genera of Hyphomycetes, 11 new species, and one new combination) in the press. He was joint author with Dr. Dorothy Shaw of "White leaf streak of rice caused by *Ramularia oryzae* sp.n." (from New Guinea, North Borneo, British Solomon Islands, Sierra Leone, and Nigeria), which has been accepted for the *Trans. Brit. mycol. Soc.* and several articles for *Taxon*.

Dr. Booth published *Mycological Paper* No. 73, Studies in Pyrenomycetes IV, *Nectria* (pt 1), and No. 74, Studies in Pyrenomycetes. V: Nomenclature of some *Fusaria* in relation to their Nectroid perithecial states.

He co-operated with J. S. Murray in writing "*Calonectria hederae Arn.* and its *Cylindrocladium* conidial state" for publication in *Trans. Brit. Mycol. Soc.*

Dr. Ainsworth was joint author with P. K. C. Austwick of the book Fungal Diseases of Animals, published as *Rev. Ser.* No. 6, Commonwealth Bureau of Animal Health, 1959, and contributed "Diseases due to fungi" to the book Infectious Diseases of Animals, By Galloway and Stableforth, 1959.

He also gave a series of three special University of London Lectures at the Royal Veterinary College on fungus diseases of animals, read a paper at the Exeter meeting of the Association of Applied Biologists, and addressed the Microbiological Society and the Biological Society of Chelsea Polytechnic.

58. *Culture Collection*. The total in the collection now numbers 2,821 (2,524 in 1958). New accessions numbered 324; 27 were lost or discarded.

A total of 1,802 cultures were issued: 815 to industry (697); 755 to research and educational establishments (742), and 232 free in exchange or as free issues to Commonwealth workers (156). The last figure represents an increase of 50% and indicates further activity in the work of the Culture Collection. Sales amounted to £755 (£718).

Enquiries have been more varied and interesting as well as more numerous than in any previous year. Particularly is this true for schools and other educational establishments. It does appear that many teachers of microbiology and biology in general are not fully conversant with mycological

techniques and nomenclature, and teaching material is sometimes inadequate or inaccurate. With the rapid rise in the number of technologists in biology now being trained this deficiency needs immediate correction, and the assistance of this Institute is being sought more and more by teaching staff.

Many more enquiries have been received from and visits made by industrialists. Enquiries have ranged from moulding of delicate instruments to mould contamination of the water cooling system in a power-house. U.K. Government engineering departments and the British Standards Institution have been given much assistance in drawing up new and unified specifications for tropic testing of mould-proofing procedures.

Other interesting enquiries embrace mould contamination of analytical reagents and of rat bait laid in sewers, filming soil pests, moulding of optical lenses, fungal parasites of locusts, and cultural techniques used at the Institute.

Most of the problems have been solved following advice given by the Culture collection staff.

Major Dade published two articles on laboratory techniques in *Commonwealth Phytopathological News* and contributed a large section to the handbook on C.M.I. methods.

59. *Becteriology*. Dr. Hayward spent three months with Dr. W. J. Dowson at Cambridge and confirmed the pathogenicity of a number of pathogens.

He has commenced a study of identification techniques for *Pseudomonas solanacearum* and has found that a sudanophilic substance, poly-β-hydroxybutyric acid, which occurs infrequently in pseudomonads and is easily detectable by a single staining method, is invariably present in quantity in all authentic cultures of *P. solanacearum* so far examined by him. On this basis several records of this important pathogen in different parts of the world cannot be substantiated. He has submitted an article on his finding to *Nature, Lond.*

He has also commenced an investigation of the causal organism of the controversial cushion gall of cacao. Material has been received from Ghana and Central America for comparison. The work is being conducted in co-operation with plant pathologists in those countries who are undertaking inoculation tests with isolates obtained at the Institute.

Assistance is also being given to the Sugar Research Institute, Mauritius, in identifying the bacteria associated with gumming disease of sugarcane in Mauritius and Reunion where different strains are thought to occur.

Interesting new records are *Xanthomonas vasculorum* on sugarcane in Southern Rhodesia and *P. solanacearum* in wilted teak seedlings in North Malaya.

Dr. Hayward published an article on plant bacteriology in the *Commonwealth Phytopathological News* and read a paper on the classification of plant pathogenic bacteria at an 'open' conference of the National Agricultural Advisory Service.

60. *Photography*. In addition to the work recorded under *Information Services* there has been much work done for the Herbarium, involving 4,520 photographs, and photocopying Icones Fungorum, Systema Vegetabilium, and a number of other books.

Assistance has also been given to the mycologists in the production of photomicrographs and lantern slides.

Reprinting of the *Review of Applied Mycology* has continued steadily.

61. *Inter-African Phytosanitary Commission*. Mr. Altson has supplied 4 further lists providing information on synonymy, geographical distribution, natural hosts, and modes of transmission of some 250 plant viruses. A fifth list and a list of natural host plants is in preparation.

Contact with the Scientific Secretary has been constantly maintained and advice given for his circulars.

62. *Pool of Plant Pathologists*. Mr. Holliday has continued his work on *Phytophthora* foot-rot of pepper (*Piper nigrum*) in Sarawak. Two of the introduced Indonesian varieties have shown considerably more resistance than the local varieties, with Indian introductions intermediate. Field trials have shown that young pepper vines are as susceptible as mature ones and that spread of the disease can be checked by the application of cuprous oxide drenches.

The suspected virus disease recorded last year has been shown to be due to that cause and named pepper stunt virus disease. The results of transmission experiments were published in *Phytopathological News*.

Dr. Wheeler has confirmed that wither tip (*Gloeosporium limetticola*) of limes in Zanzibar can be economically controlled by spraying with 3 lbs: 100 galls. water of kramsol (phenyl mercury nitrate) provided the applications are correctly timed. Captan was also effective but too expensive. Seven other fungicides were ineffective. Owing to the poisonous nature of mercury salts, investigation of spray residue has been kindly undertaken by Prof. H. G. H. Kearns of Bristol University.

Fertiliser trials have shown an increase in shoot growth due to nitrogen and a reduction due to potassium, but no direct response in disease severity.

Investigations on the spread of the disease in a plantation are continuing.

63. *Publications.* Sales of publications and cultures amounted to £12,519 an increase of £334 over 1958/59. Subscribers to the *Review of Applied Mycology* increased by one from 1,496 to 1,497 and total distribution from 1,811 to 1,821. Sales increased from £6,852 (back numbers £1,756) to £7,695 (back numbers £2,559), the large increase in sales of back numbers being due to more availability of single parts as a result of reprinting.

Distribution of the *Review of Medical and Veterinary Mycology* rose from 438 last year to 463 but sales decreased from £1,169 to £1,121 due to a drop in sales of back numbers.

The assistance of several voluntary outside abstractors is gratefully acknowledged, especially that of Prof. Juan E. Mackinnon of the University of Montevideo.

Mycological papers Nos. 71 to 75 were published but issue was delayed by the printing strike. Sales amounted to £837 compared with £555 last year.

Subscribers to the *Commonwealth Phytopathological News* increased by 10 from 406 to 416, sales amounting to £118, and of *Index of Fungi* from 403 to 432. The sales of the latter, however, dropped from £545 to £396, again due to a drop in orders for back numbers, which last year were phenomenal.

No *Phytopathological Papers* were published but two are in preparation. There was no marked change in orders for *Distribution Maps of Plant Diseases*, but orders for the *Bibliography of Systematic Mycology* rose from 49 to 64.

The 4th edition of Bisby and Ainsworth's Dictionary of the Fungi is now sold out and an enlarged 5th edition is with the press. A book Diseases of Sorghum by Dr. S. A. J. Tarr is in the final stages of editing and should be published during 1960/61.

64. *Information Service.* Orders have been supplied as follows:

Microfilms—80 (4,500 pages) to 29 countries
Photocopies—234 pages
Enlargements—153 prints
Books and reprints on loan—200

36 parts of the *Review of Applied Mycology* have have been reprinted at the Institute and 57 parts reprinted by Central Sales. Twelve complete sets are now in stock and it is expected to increase these considerably during 1960/61.

All out of print *Mycological Papers* have now been reprinted and complete sets are available for sale.

65. *Changes in staff.* Mr. E. W. Mason, head Mycologist, retired in February, 1960 after 40 years' service. Dr. Ellis has taken charge of the Herbarium.

The following appointments were made: Assistant Mycologists, R. R. Davies, G. F. Laundon and B. C. Sutton.

COMMONWEALTH INSTITUTE OF BIOLOGICAL CONTROL

66. Headquarters of the Commonwealth Institute of Biological Control has remained at Ottawa. The Director has, however, visited all the Stations, and has been on tour in Pakistan, India, Ceylon, Malaya, New Guinea, Australia, New Zealand and East Africa during the year. These tours have been very valuable, and as a result numbers of additional projects will undoubtedly be submitted to the Institute, the general usefulness of which is being more appreciated by contributing countries.

67. Dr. Lloyd, Entomologist-in-Charge of the California Station, has spent some four months in Mexico investigating natural enemies of the froghoppers, *Aeneolamia* spp.

68. From the European station a number of projects have been carried out for Canada, New Zealand and Bermuda, covering a wide area in Europe. Co-operative work, and exchange of insect material have developed with Russia, Czechoslovakia, Bulgaria and Poland, particularly with regard to forest pests of interest to Canada.

At the West Indian Station projects have been continued for Barbados, Bermuda, Ceylon, Dominica, India, Jamaica and Mauritius.

The India Station has developed project activity considerably for Australia, Canada, Ceylon, India and Mauritius.

A survey of parasites and predators of insect pests of Pakistan has been started at the Pakistan Station, where work on *Adelges* predators (Canada) and San Jose scale parasites (Pakistan), as in India, is being continued with promising developments.

In connection with these projects an extensive area has been explored by different officers, the most interesting perhaps being an exploratory trip by Dr. V. P. Rao in search of additional *Adelges* predators (for Canada) into Sikkim in the Eastern Himalayas.

The members of the staff have continued research work into various aspects of biological control connected with the different projects.

69. Staff changes. Nothing to report.

Animal Breeding and Genetics

70. *Staff.* Mr. P. W. Swire, M.R.C.V.S., was appointed Assistant Director and took up his duties on 2nd November, 1959.

71. *Accommodation or equipment.* The proposal to house the Bureau in the new headquarters of the Animal Breeding Research Organisation of the Agricultural Research Council was finally approved. The plans, which provide for a joint library, have not yet received the approval of the Treasury or the University.

72. *Publications.* Volume 27 of *Animal Breeding Abstracts* contained four review articles, 2,065 abstracts and 132 titles. Delays in publishing the last two parts and the index, due to the printing dispute, were only slight and the index appeared about a month after the fourth part. The number of journals and other publications scanned continues to increase and for most of the year there was great difficulty in keeping abreast of the work.

73. *Information Service.* There were 91 major enquiries during the year, 36 of which came from the United Kingdom, 29 from other Commonwealth countries, 9 from associated countries (Republics of Ireland and the Sudan) and 17 from foreign countries. Enquiries invariably cover a wide range of topics and this year included: information on sheep breeds suitable for the wet tropics; the use of imported European sheep breeds in the tropics; the extent to which Indian breeds of cattle and buffalo have been used in other countries; chinchilla breeding; the genetic aspects of response to drugs; sex control in cattle; the effect of music on milk yield of cattle; and the effects of age and methods of storage on egg hatchability.

The Bureau prepared four translations and supplied photostat copies of 4 papers and one microfiche copy.

74. *Library.* The library issued on loan a total of 752 books and journals and borrowed 1,356 items; this last figure is an increase of 33% over the previous year.

75. *News-letter.* Interest in the News-letter has again been shown by several correspondents and it is considered to form a very useful link with many of the Bureau's correspondents and contacts.

Animal Health

76. *Staff changes.* Nothing to report.

77. *Publications.* All three periodicals are up-to-date and all have shown small increases in sales during the year. The volume index for *Veterinary Bulletin* Vol. 29 is in the hands of the printer and will we hope be ready for issue by the end of April, 1960.

Sales of *Veterinary Reviews and Annotations* although they have increased by about 5·7% are still rather disappointing.

One Technical Communication, namely Review Series No. 6 *Fungal Diseases of Animals* was published in June, 1959. It is the Bureau's first Review Series to contain illustrations in colour. Sales up to the end of December, 1959, have been encouraging. It has been very favourably reviewed in a number of journals both British and foreign.

78. *Information Service.* The information service dealt with 83 enquiries of which ten came from the Dominions, seven from other Commonwealth countries, eleven from foreign countries and 55 from the United Kingdom. They covered a wide range of subjects including selenium as an essential dietary element; diseases of chinchillas; risk of introduction of foot and mouth disease into Fiji by onions imported from Spain and Holland; risk of introduction of rinderpest into Paraguaya by importation of zebu cattle; sheep-pox vaccines; possible excretion of trypanocidal drugs in milk of dairy cows; the anatomy of the buffalo; the mucosal disease complex in cattle; warfarin poisoning, etc.

79. *Miscellaneous.* Books to the value of £274 were received from publishers for review in the *Veterinary Bulletin.*

The figures for nett revenue from paid advertisements for the full year are not available at the time of writing but it is estimated the total will be about £300.

Animal Nutrition

80. *Staff.* Dr. Leitch retired from the Directorship and was succeeded by Dr. D. Harvey, Assistant Director. The vacancy caused was filled by the appointment of Dr. Dorothy L. Duncan, Scientific Assistant, as Assistant Director. Dr. Leitch was reappointed on a part-time basis for special duties.

81. *Publications.* (*a*) The journal continued to grow in size, Volume 29 having 107 more pages and containing 372 more abstracts but 51 fewer titles than did volume 28. The total number of entries, numbered and unnumbered, was 9,914.

(*b*) Of the four Review Articles published during the year, the second, by Dr. Leitch, re-examined after twenty-two years the subject of the estimation of the calcium requirement of man. The fourth dealt with the use and development of land in the United Kingdom.

(*c*) A Technical Communication, *Diet in relation to reproduction and the viability of the young. Part 2 Sheep. World Survey of reproduction and review of feeding experiments,* by Mr. W. Thomson of the

Duthie Experimental Stock Farm and Mrs. F. C. Aitken, was published.

82. *Information Service.* The number of enquiries received, 55, was greater than in the preceding year; 45 were from countries within the Commonwealth, 10 from foreign countries. Of these, 34 concerned animal and 12 human nutrition, the remainder being on more general subjects such as methods of estimating nutrients. Seven translations were provided, 2 from Russian, 1 from each of Dutch, German and Spanish, 1 into French and German and 1 into French.

The subjects varied widely. For a visitor to the Bureau on leave from Northern Rhodesia who was interested in home milling of cassava a sketch was obtained from the Director of a nutrition institute in Guatemala of equipment used for that purpose in Paraguay. A request from a laboratory in Marseilles for help in obtaining for analysis samples of West African foods was taken up by two medical officers who were approached by personal letter. No reply was received from three official correspondents to whom the request was referred in the first place.

Publications borrowed from the Reid Library through the Bureau numbered 46.

83. *Sales.* Total circulation of *Nutrition Abstracts and Reviews* rose by 80 over that for the preceding volume to 2,085 copies. The number of subscribers was 1784.

Total income including that from sales of back numbers, reprints and indexes was £12,980. The total value of circulation of Volume 29 was £13,507.

Dairy Science and Technology

84. *Staff.* Dr. A. T. R. Mattick ceased to be Consultant Director on his retirement from the Acting Directorship of the National Institute for Research in Dairying and Professor R. G. Baskett, the new Institute Director, was offered and accepted the Consultant Directorship in October, 1959.

85. *Publications.* Thanks to the emergency measures taken during the printing dispute in the summer of 1959, the publication of the journal was never greatly delayed. The worst affected part was the August issue which was 'type-set' at the Bureau, but even so the delay was only about six weeks and this and the September issues were the only two not published during their month of publication.

Volume 21 (1959) contained the record number of 3,038 abstracts and 198 title entries. In addition, review articles were published regularly in the journal.

The annual indexes to Vol. 21 were published, in record time, in February, 1960.

Coverage of the literature continues to increase and some 540 journals are now scanned regularly, apart from numerous bulletins, annual reports, books and other publications. Nearly 40 per cent. of all abstracts and titles appearing in *Dairy Science Abstracts* were from foreign language papers, German continuing to be the most important foreign language followed by Russian.

86. *Journal sales.* Largely as the result of a bulk purchase arrangement with the American Dairy Science Association, the number of subscribers to *Dairy Science Abstracts* rose from 1,023 for Vol. 20 to 1,815 for Vol. 21 and total distribution of the journal from 1,240 to 2,040 respectively. This is the first time that journal sales exceeded 2,000 and early indications for sales during 1960 are very encouraging.

87. *Information Service.* A total of 176 enquiries was received and dealt with during the year. Of these 71 came from Great Britain, 43 from different parts of the Commonwealth and 62 from foreign countries.

The nature of the enquiries received varied considerably. Several interesting enquiries were received from Commonwealth countries. Information on the use of the methylene blue and resazurin tests for estimating the hygienic quality of milk was supplied to a Canadian firm.

The latest information available on a new Dutch Instant dried whole milk product was supplied to the Dairy Division of the New Zealand Department of Agriculture; while the National Dairy Association of New Zealand Ltd. was supplied with data on a special salt used in butter manufacture in Sweden.

Detailed information on suitable machine milking, farm cooling and farm milk bottling equipment was given to the Senior Veterinary Officer in North Borneo who, incidentally, is also the Official Correspondent of this Bureau.

The Indian Council of Agricultural Research asked for details of any studies on the effect of music on the milk yield of cows and buffaloes while the Indian Association for the Cultivation of Science was given details of a new British process of milk preservation using ultrasonic waves.

Enquiries from South Africa included two on the utilization of dried whey and on dried cheese respectively, both from the National Nutrition Research Institute.

88. *Advertisements.* The journal continued to prove a good medium for commercial advertising and, largely due to the special International Dairy Congress issue, Vol. 21 contained 73½ pages of paid advertisements.

89. *Publicity*. Bureau publications were exhibited both at the XV International Dairy Congress in London in July, 1959 and at the Dairy Show in London in October, 1959.

Forestry

90. *Staff*. There was only one change, a Scientific Assistant unexpectedly resigning, and her post could not be filled for six months. This loss, at a time of extra commitments (notably the completion of a 5-year index), has thrown parts of the work programme in arrears. Three of the 8 abstractors are young 'arts graduate' (linguist) men still learning the bases of forestry science.

From 1st October, 1959, Professor M. V. Laurie became the new Consultant Director to the Bureau *vice* Professor Sir Harry Champion, retired.

91. *Publications*. (*a*) *Forestry Abstracts*. The preparation of abstracts continues to be the major pre-occupation of the scientific staff. Two numbers, and the annual index to Volume 19 appeared late owing to difficulties in the printing industry; part of the index to Volume 20 is in the press. Volume 20 contained 5,452 abstract notices (the highest yet) from 34 languages.

(*b*) *Coverage of literature*. Reappraisal continues in connection with the revised type of Coverage List (in preparation with F.A.O.) and discards have somewhat exceeded current accessions of literature.

(*c*) *The Botanical Pool* of circulating literature (some 246 items) continued to be run by this Bureau, which also continued the distribution of scientific literature received at Head Office.

(*d*) *Occasional Publications*.

(i) *Special projects*. Compilation of Part II of the five-year index to Volumes I-V of *Forestry Abstracts* is in progress.
Publication of the illustrated brochure on the Bureau has been held up by successive delays in completing the coloured line drawings.

(ii) *Technical Communications*. A suitable compiler has now been found for the long suspended T.C. on Shelterbelts.

(*c*) *Centralized Title Service*. This weekly service continues its steady growth, with 4 more Commonwealth and 9 more foreign subscribers during the year, a total of 104 centres taking nearly 800,000 cards, of which 43% went by air. New countries subscribing were Chile and Denmark.

92. *Information Service*. (*a*) A total of 30 enquiries was received and dealt with from member or associated countries, the same figure as last year, plus 11 (an increase of 9) from foreign countries. Among topics on which information was provided were:

1. Measurement of dew and other forms of condensation.
2. Techniques in breeding *Acacia arabica* for resistance to cold.
3. Tree/soil relationships of *Copaifera mopane*.
4. Stimulation of cork and acorn production in *Quercus suber*.
5. Storage of seed of tropical broad leaved species.
6. Complete information on *Ailanthus altissima* (*A. glandulosa*).
7. Protection of underground pipe systems from tree and shrub roots.
8. Fire as a forestry tool in Africa.
9. Suitability of *Hevea brasiliensis* wood for pulping.
10. Hydraulic transport of wood chips.
11. Legislation for the control of Poplar propagation.
12. English forestry as a provider of employment.

(*b*) In addition there were 34 requests, involving 64 items, for literature; 3 photostats, 2 microfilms, and 2 translations were also supplied.

93. *Miscellaneous*. The authorized edition in Spanish of the *Oxford System of Decimal Classification for Forestry* has been published; that in French should appear shortly.

A code of procedure for classifying forestry films, originally drafted in the Bureau at the request of the European Forestry Commission, F.A.O., will shortly be published in UNASYLVA for general guidance.

Helminthology

94. *Staff*. The Taxonomy Unit is now functioning and an experienced taxonomist—Mr. W. M. Fitzsimmons, F.R.C.V.S., Dip. Agric. (Stellenbosch), Dip. Trop. Med. (Antwerp)—has been appointed. Material received for identification was dealt with by the taxonomist with the assistance of outside specialists.

Miss Alice Walton, M.B.E., who had been a member of the staff of the Bureau from its foundation, died on 4th December, 1959.

95. *Publications*. (*a*) Volume 25 of *Helminthological Abstracts*, with author, subject and periodical indices, was completed and published during the year. The first part of the new-style *Helminthological Abstracts* (volume 29, part 1) was issued.

(*b*) A first supplement to The *Nematode Parasites of Plants Catalogued under their Hosts*, by Dr. J. Basil Goodey, Dr. Mary T. Franklin and David J. Hooper; and *List of Plants Resistant to Root-knot*

Nematodes (Meloidogyne spp.), by Dr. Mary T. Franklin and David J. Hooper, were published during the year.

The following occasional publications are in course of preparation: *Ecology of the Free-living stages of the Nematode Parasites of Sheep in Relation to Flock Behaviour and Population Dynamics in Host and Parasite*, by Dr. H. D. Crofton; *Proprietary and Chemical Names of Anthelmintic Preparations*, by Dr. S. M. Willmott; *Histological Reactions to Helminth Infections*, by Dr. G. Lapage; *Factors Affecting Emergence of Larvae of the Genus* Heterodera *from their Cysts*, by Dr. Audrey M. Shepherd; *Veterinary Anthelmintic Medication*, by Dr. T. E. Gibson; *Nematicides*, by Dr. J. E. Peachey.

96. *Information service.* Some 80 requests for information were dealt with during the year, 63 from contributing countries and 17 from non-contributing countries and international organizations. The topics included:

Canine helminths parasitic in human skin; trichinelliasis in Africa; treatment of an acute case of parasitic gastro-enteritis contracted in Spain; supplies of schistosome cercarial antigen for diagnostic purposes to the Tropical Diseases Hospital, London; human trichostrongylosis in Iran; filarial infection in birds and in domestic and wild animals in the U.K. and the possibility of zoonoses transmissible to man; control of leeches attacking workers in rice fields in north Australia; schistosome dermatitis in the U.K.; effects of chemical and physical agents on the viability of tapeworm eggs, with a view to controlling the spread of infection through ingestion of infested meat; experimental completion in the laboratory of the life-cycle of *Onchocerca volvulus* through the vector fly *Simulium damnosum.*

Helminth diseases of goats in Africa; morphology, physiology and life-histories of nematode worms parasitic in sheep; possibility of infecting horses with *Schistosoma mansoni*; the effect on worm parasites of sheep of different regimes of winter grazing as opposed to folding (for a farming programme on B.B.C. Television); life-cycle and control of *Metastrongylus apri*, *Stephanurus dentatus* and *Oesophagostomum columbianum* in pigs in the Bahamas; helminth parasites of domestic animals in British Guiana, in North Borneo, and in Basutoland; hydatid disease of horses in Northern Ireland; helminth parasites of Indian mongoose.

Developments in plant health with special reference to eelworms; eelworm infestation of manila hemp in North Borneo; eelworms in the West Indies; identification of eelworms isolated from rice in Ceylon; exchange of information between nematologists working in the tropics; a new species of protozoon parasitic in *Meloidogyne*; fungi parasitic on nematodes in India; *Pratylenchus goodeyi* as a parasite of banana roots; identity of specimens of *Heterodera.*

The species of the Genus *Trichuris*; identification of a miscellaneous collection of specimens from various avian hosts in Pakistan; identification of a paramphistome from *Cervus timoriensis moluccencis* from West New Guinea; taxonomic relationship and possibility of hybridization between *Schistosoma haematobium* and *S. bovis* in Iraq; fixation and preservation of helminth specimens for taxonomic purposes.

Biology and biochemistry of molluscan vectors of schistosomiasis; snail physiology in relation to the efficacy of molluscicides; ecology of schistosome vector snails in irrigation canals in Egypt in relation to control; possible establishment of breeding colonies of schistosome vector snails in covered irrigation channels in Iraq.

Institutions in the U.K. carrying out helminthological research; di-n-butyl tin dilaurate as an anthelmintic; organisation of nematological research and bibliographical tools connected therewith; obtaining helminthic material for teaching; careers and prospects of employment in helminthology; bibliographical criticism and advice in several special spheres of helminthology for W.H.O.

97. Requests for the loan of specific items of literature numbered 96, and requests for microfilms and photocopies numbered 39.

A photocopyer has been installed in the Bureau and a photocopying service advertised in the Bureau journal.

98. One translation was supplied on request, involving a direct approach to the Russian scientist concerned.

99. *Miscellaneous.* The changes made in the format and issue schedule of *Helminthological Abstracts* have been very favourably commented upon by various leading helminthologists and officials of the Ministry of Agriculture, Fisheries and Food.

The Bureau, in response to requests from several different quarters, is conducting a kingdom-wide investigation of the incidence of hydatid disease in domestic animals and man with a view, *inter alia*, to promoting the introduction of regulations governing the resale of infected offal for pet food.

The total number of overseas visitors during the year was 11.

Horticulture and Plantation Crops

100. *Staff.* On 1st April, 1959, G. K. Argles succeeded D. Akenhead as Director. On 15th July, 1959, G. E. Tidbury succeeded G. K. Argles as Assistant Director.

101. *Publications.* (*a*) *Horticultural Abstracts.* Volume 29 was published on time, with the exception of No. 3 which was issued three weeks late. The annual indexes and No. 4 were issued simultaneously within the one cover. Volume 29 contained abstracts, notes or reviews of 5,627 original articles and books. The number of subscribers declined from 1,262 to 1,233.

(*b*) *Occasional publications.* Digest No. 2, *Mist propagation of cuttings*, appeared early in January, 1960.

102. *Information Services.* (*a*) *Existing services.* Enquiries dealt with rose by 39% to reach a total of 209, made up of 93 from the United Kingdom, 48 from the Dominions, 22 from the Colonies, 2 from the Republic of Ireland and 44 from other foreign countries.

Official Correspondents and all readers of *Horticultural Abstracts* were notified of the availability of copies of replies to the more interesting enquiries. As a result 198 persons were supplied with 716 copies of replies to 101 enquiries.

Subjects of enquiries covered a wide range, including petroleum by-products causing smog which may damage plants, methods of handling bananas prior to shipment; the application of trace elements to apple trees; vitamins as plant foods or stimulants; growth substances used to induce fruit set or parthenocarpy; and standard types of container in which to handle and weigh crops from field experiments.

(*b*) *New Services.* From October, 1959, the Bureau offered to provide photocopies or microfilms of original papers at reasonable fixed prices and also translations at prices much below those hitherto available. In the first five months following the announcement of the services 29 persons received 70 photo copies and 36 microfilms (the latter provided with the help of East Malling Research Station) but only 11 translations were requested of which six were undertaken.

103. *Publicity.* Bureau publications were again displayed at the Chelsea Flower Show, London, in May, 1959. In an attempt to bring Digests Nos. 1 and 2 to the notice of persons who might find them of interest 8,000 leaflets with order forms were printed for distribution in *Horticultural Abstracts* and by mail. Despatch of the latter to selected addresses started in January, 1960, with encouraging preliminary results.

Pastures and Field Crops

104. *Staff.* Nothing to report.

105. *Publications.* The journals *Herbage Abstracts* and *Field Crop Abstracts* appeared quarterly, but because of a strike by printers some issues were delayed by as much as six weeks. The total number of abstracts and titles, derived from 11 languages, was 1,830 in *Herbage Abstracts* and 2,093 in *Field Crop Abstracts.* Since 1955 the number of abstracts and titles published annually in both journals, taken together, has increased by 36%. Each issue of both journals included a review article, in addition to the abstracts. The annual subject- and author-indexes of *Herbage Abstracts* and *Field Crop Abstracts* were published with the last issue of each volume. A revised list of over 1,000 world periodicals and reports received regularly in the Bureau for abstracting was published. Three technical communications were published in mimeograph form. There were small increases in the circulation of *Herbage Abstracts* and *Field Crop Abstracts.*

106. *Information service.* 89 enquiries (78 from Commonwealth countries and 11 foreign) were dealt with, plus 190 requests for references to scientific literature, 112 requests for reproductions (microfilms or photocopies) and 29 requests for translations.

Enquiries received covered the following subjects, amongst others:

References to *Panicum coloratum*; taxonomy of *Bromus unioloides*; sod-seeding; effect of altitude on forage species; fire in relation to grasslands; influence of height of cutting on growth and yield of grasses; vitamin D content of herbage; carotene content of herbage and fodder crops; use of sodium metabisulphite in silage-making; *Lantana camara* and its control; land reclamation in Great Britain; frost damage to seedlings covered with snow; N and P metabolism in wheat; barley-growing in tropical areas; herbicides for rice; benefits from sprouting potatoes; classification schemes for mangels and fodder-beet.

Lists of the more important enquiries answered were published in *Herbage Abstracts* and *Field Crop Abstracts* and carbon copies of replies were offered to those who wanted them.

The Director of the Bureau visited the following Commonwealth countries during the period 2nd November, 1959 to 10th February, 1960: Malta, Uganda, Kenya, Zanzibar, Tanganyika, The Federation of Rhodesia and Nyasaland, The High Commission Territories of Bechuanaland, Basutoland and Swaziland and the Union of South Africa.

107. Twenty-four scientists from overseas visited the Bureau.

Plant Breeding and Genetics

108. *Staff.* No changes.

Except for a delay in the issue of one part due to the printers' strike, *Plant Breeding Abstracts* has continued to appear punctually at the beginning

of each quarter. Volume XXIX contained 4,620 abstracts, 100 books reviews and 5 new journal notices. Publications in 35 languages were examined in the course of preparing *Plant Breeding Abstracts* and 9 other languages were dealt with in the course of the Bureau's work.

109. There were 46 technical enquiries, 40 from contributing countries, 2 from F.A.O. and 4 from foreign countries. These included requests for information on the following topics: irradiation breeding, for Australia; clover vernalization, cereal yield components, lucerne breeding, Japanese rape, viability of tomato pollen and genetics of ear and plant height in maize, for Canada; male sterility and cross pollination in wheat, for Kenya; heterosis in tobacco, for India; yield components, photoperiodism and flowering of sugar cane, for Mauritius; kola pollination and soya-bean hybridization, for Nigeria; cold resistance of *Acacia* and pollen viability of grasses, for Pakistan; taxonomy of *Phaseolus*, for Uganda; and tetraploid maize, oilseed breeding, *Eucalyptus* cytology, Japanese work on hop cytology, mutagenic applications of ethyleneimine, theory of breeding, sugar-beet isolation distances and evolutionary history of sorghum, for the United Kingdom.

110. Requests for specific items of literature totalled 106; 109 requests were made for bibliographies previously compiled. Six translations were made, four from Russian and two from Spanish. Requests for typescript, photocopy or microfilm reproductions totalled 19.

111. Assistance in obtaining genetic material of Russian cereals was rendered to three research workers and arrangements were made for sending English wheat varieties to Germany.

112. Visitors to the Bureau included: R. F. Peterson from Canada; K. O. Müller from Germany; and Prof. A. S. Radov from Russia. The Bureau continues to be consulted on automation of scientific-information files and two special demonstrations to visitors were arranged.

113. The Director attended a symposium organized by the Plant Breeding Section of the German Society of Agriculture at Stuttgart-Hohenheim and read a paper in German.

Soils

Staff. No changes.

114. Abstracting and publication of *Soils and Fertilizers* are up-to-date. Volume XXII (1959) contained 2,991 abstracts and 7 review articles. In all, about 7,000 papers, etc. were indexed. Several new journals dealing with soil science came under review.

115. Technical Communication No. 50, *Relations between Water and Soil*, was issued during the year. No. 51, *The Soil under Shifting Cultivation*, was sent to the press.

116. The number of enquiries received was 141, compared with 108 last year. Of these 66 came from the United Kingdom, and 53 from other contributing countries. Among the subjects of enquiry were: effect of burning on tropical soils (U.K.); iodine in soils (Basutoland); influence of soil moisture and temperature on plant growth (Canada); use of monomolecular films for reducing evaporation (Canada); effect of root excretions on soil processes (S. Rhodesia); use of copper fertilizers for tea (Nyasaland); toxicity of heavy metals in soil (U.K.); measurement of root-surface areas (Australia).

117. Three translations were made from Russian, two from Czechoslovakian and two from German.

118. Ninety-eight annotated bibliographies were prepared.

NOTES OF PROGRESS IN THE AGRICULTURAL SCIENCES, BY DIRECTORS

Entomology

119. To the casual observer on the bank, the progress of a boat being rowed upstream may seem disproportionately slow in relation to the energy expended by its crew. Progress in agricultural entomology is generally similar, and a proper evaluation must take into account the force of the opposing current. This, in the main, is represented by the natural resilience of biological material, and by the undesirable side-effects of men's own agricultural activities. The biota is so delicately balanced, and ecological niches so well filled, that scarcely any change be can be made without benefiting some arthropod or other. The trend towards intensive cultivation, slow but inevitable, involves an increasing degree of environmental control, and action to this end results not infrequently in creating, or prolonging, circumstances which favour the multiplication of insects. Where irrigation has been introduced, for example, more than one hitherto negligible insect is now appearing as a crop pest (as, for example, *Baris granulipennis* Tour. on water-melons in Israel), or recognised pests are able to maintain their numbers at an injurious level (46:121*). The situation may be similar where crops are grown successively instead of inter-

*In paragraphs 119–137 references given only in figures refer to volume and page in the *Review of Applied Entomology*, Series A, those prefixed with B refer to Series B.

mittently: in Central and East Africa the sorghum midge, *Contarinia sorghicola* (Coq.), which is uncommon in peasant holdings, is a pest at agricultural research stations where sorghum is constantly present. Even the application of insecticides, in appropriate climatic conditions, may pave the way to a renewed outbreak of the very pests against which they are used, by clearing the field of both the pest and its complex of enemies, and so permitting early recolonisation of the area by survivors or immigrants.

120. The use of insecticides furnishes a swift answer to many problems of economic entomology, and this approach is deservedly popular. But the cost of effective treatment increases proportionately as the insect pest acquires resistance, and can rapidly become uneconomic. The search for insecticides which are effective and cheap needs to be maintained constantly and over the past few years has been prosecuted with increasing vigour; the result is reflected in the number of insecticidal compounds now in regular commercial use, which is almost four times that only seven years ago. The task of testing these against a wide variety of pests is today a major activity, and the reports of such tests form about a quarter of the total literature on applied entomology.

121. At the opposite end of the chain of events which makes such tests possible, an appreciable amount of fundamental research is devoted to ascertaining the metabolic changes in the subject which supervene in the presence of insecticide, to discover how the insecticide operates within the body and by what means, if any, it is detoxified; such studies embrace not only insects, but vertebrates and even plants, and in the first extend to cover transmissibility of insecticide resistance from parent to offspring. The requirements which have to be considered in developing new compounds are many, but the two basic factors are humanitarian and financial. In one approach the attempt is made to widen the gap between levels toxic to insects and those toxic to mammals (cf. B 48: 25); in another, to increase toxicity to insects and so reduce cost. The end to be achieved is usually death of the insect, but, where chronic infestation has to be dealt with, it is recognised that even a lowering of fecundity might lead to an adequate reduction of the population.

122. With the safety margin so narrow in some of the more recent insecticides, their adoption for widespread use presupposes a working knowledge of the conditions in which they may produce adverse effects. Much of the investigational work in this field, discussion of which occupies about two and a half per cent. of the total literature, has been devoted to measuring the amounts of insecticide in food obtained from plants or stock which had received treatment. On the whole, the findings have been generally reassuring, as far as hazard to human health is concerned, but as regards quality and flavour of produce it would appear, in some crops, difficult to ensure that treatment will affect neither, irrespective of the prevailing environmental conditions (45 : 8). From similar precautionary motives, studies have also been made of insecticides in the soil, of their movement, persistence, and effect on seed germination and growth of seedlings, and of their effect on the soil fauna (45 : 63, 180, 408). It seems clear that each system (soil type, weather, and the biota concerned) has to be evaluated by itself; there is little basis for generalisation, apart from the fact that undesirable effects may, at times, result even from normal use of insecticides in apparently normal conditions. The last of the common items in this aspect of study is the incidental injurious effect of insecticides on insect predators and parasitoids and on flower-pollinators (47 : 14, 42, 66). The findings, which are derived from a comparatively small number of investigations, suffice to indicate the need for careful choice of insecticide if such injury is to be kept to a minimum.

123. The use of toxic gases has been given relatively little attention, and such investigations as have been reported have been chiefly concerned with technical details regarding well-known fumigants against storage pests. On this front, at least, the position seems to be satisfactory and reasonably stable.

124. Systematic investigation of the problem of repelling insects has virtually been neglected in the recent past. In a fundamental approach, the relevant properties of olfactory stimulants have been studied in relation to response in *Glossina* and *Phormia* in order to estimate the most promising combination of physical properties for securing a response (B 45 : 183). In one of the few other studies it was reported that the insects tested were repelled (or even poisoned) by the dried and powdered remains of specimens of their own species, but not by those of other species (45 : 210). The repellant effect of certain insecticides against specific pests has also been remarked fairly frequently but there has been little attempt to exploit this property. Little has been reported, too, in the complementary line of investigation, the study of attractants: the principal feature in this field has been work centred on compounding mixtures of high attractiveness to adult fruit-flies.

125. The physical and mechanical aspects of applied entomology have formed the subject of comparatively few reports. Methods of application have included no really novel approaches, unless the introduction of insecticidal resins is regarded as such, but it is evident that an appreciable amount of

effort has been expended on attempts to adapt low-volume spraying technique to a wide range of problems (45:460, 47:373). In forestry work, methods are being sought to permit more extended use of aircraft as a means of surveying insect infestation (45:100); it would seem that the more obvious situations for economic use of conventional aircraft for application of insecticide have already been exploited.

126. Studies on the effect of radiation on insect pests and on their parasitoids have understandably not been common, as the field is comparatively new, and have largely been in the nature of exploratory skirmishes. The main lines have been the investigation of methods for producing 'tagged' insects in the developmental stage needed for subsequent observation, and examination of the effect of irradiation on insect populations. The effect of heat induced by infra-red rays and electromagnetic microwaves was studied in relation to *Stephanoderes hampei* (Ferr.) in coffee beans and *Tribolium confusum* Dew. and *Sitophilus granarius* (L.) in flour and whole wheat (45:252, 94), of X-rays in relation to *Bracon hebetor* Say (45:430), and of γ-rays to *Trogoderma sternale* Jayne (471:30), mostly to observe physiological reactions after irradiation at various combinations of intensity and duration.

127. With so much field activity devoted to the problems of chemical control of pests, other aspects of applied entomology appear to be receiving less attention than their importance merits, and although the reports of such work at first sight seem to make a respectable total, they are in fact dispersed thinly over a wide range of topics.

128. There has been a moderate and steady amount of activity in the biological control of insects by the introduction of natural enemies, but the most noteworthy feature in this field has been the quickening of interest in the parallel approach using fungal, microbial or virus pathogens of insects. Investigations of the specific conditions most suitable for the rapid spread of such pathogens has so far has been very limited. Where fungi are concerned it is evident that the degree of effectiveness is to a large extent governed by the vagaries of weather, but it is, as yet, a moot point whether their victims have to be 'softened up' by environmental adversity as a pre-requisite to successful infection. Work on the use of bacteria in insect control has been reviewed by Grison (45:381). In the field of virus transmission an informative investigation by Clarke (46:125) has established that the polyhedrosis virus of *Malacosoma fragile* (Stretch) can persist through the winter on inedible parts of the food plant and can infect larvae of the succeeding generation. As a corollary to the increasing attention to this aspect of insect control, a discussion has appeared on the advisability of standardising under regulation the microbial products which may be developed and marketed for this purpose (47:14).

129. There have been few new projects for the suppression of weeds by the introduction of specific insects in the period under review. The control of *Cordia* in Mauritius by a defoliator, *Schematiza cordiae* Barb., and a seed-destroying species of *Eurytoma* has been completed (cf. 40:5) and, in Australia, a shipment of *Hylemyia seneciella* (Meade) has been received from New Zealand for use against ragwort (47:207).

130. Such, broadly, is the latest entomological chapter in the saga of scientific ingenuity aimed at destruction of the biologically unwanted. What remains to be considered may be described as fact-finding with a lesser expectation of results of immediate practical application.

131. The list of insect pests has continued to lengthen; in some instances the elevation of status results from incrimination as a vector of disease. The vector relationship itself has provided interesting subjects for study: feeding period in relation to subsequent infectivity, transmission of infectivity through the egg stage to the succeeding generation (47:407), differences between strains, or clones, of vector in ability to transmit (47:484), and, in the Aster Yellows and Peach Yellow Leaf Roll viruses, pathogenic changes in the vector after infection with the virus.

132. The insect itself has been the object of a moderate amount of study. Several of the investigations have been concerned with the effect of heat, cold, or humidity on various phases of development. The effect of high temperature on the egg stage was studied in fruit flies in Hawaii, and in the Georgian Republic (47:132, 143), and in cutworms in western Canada (47:186); on the colour and weight of newly-hatched grasshoppers (47:388) in India; and on the aestivating habits of the alfalfa weevil (*Hypera variabilis* Hbst.) and of *Hylemyia lupini* (Coq.) in the U.S.A. At the opposite extreme the effect of low temperature was investigated from the standpoint of estimating the susceptibility to cold of larvae of the European corn borer, *Pyrausta nubilalis* (Hb.) (45:93), and of adults and eggs of the leafhopper *Colladonus* (45:198) and of the eggs of the European red mite, *Panonychus ulmi* (Koch) (47:263). Studies of humidity relations included those of eggs of the garden chafer, *Phyllopertha horticola* (L.), which absorb nearly twice their own weight of water during incubation (46:145), and of adult spider mites. In five species of the latter, as represented by *Tetranychus*, it was found that the number of eggs laid by a female, and the length of oviposition period, were greater at low than at high relative humidity.

133. Studies of oviposition behaviour also involved climatic phenomena. In *Locusta migratoria* L., it was found that moist sand was preferred for oviposition, as was also a temperature approaching 100°F. (46 : 253); in *Ceratitis capitata* Wied., in a comparison of behaviour under different light intensities, it was found that females seek shaded sites for their eggs (47 : 112); and in a comparison of the attractiveness of haricot beans to *Acanthoscelides obtectus* (Say), it was established that a variety which was less attacked while on the plant in the field was also less attacked when stored, the difference being attributable to oviposition preference (47 : 153). Another phase in insect development associated with climate, if only indirectly, is diapause. In *Plodia interpunctella* Hb. and *Mamestra brassicae* L., cooling in the early developmental stages was found to be followed by diapause in the fully fed larva (47 : 33, 451) and in *Cephus cinctus* Nort., in addition to the normal autumnal diapause, a second diapause may be induced by heating the overwintered larvae before they begin metamorphosis (45 : 55). In *Tetranychus telarius* L., at temperatures below 25°C, a shortened photoperiod has been found to be the factor mainly responsible for the production of overwintering females in the Leningrad area, and the critical photoperiod has been calculated to decrease by one hour for each reduction of 3° in latitude (47 : 230).

134. The problems involved in the relationship between insects and their sources of food have attracted surprisingly little attention in view of their variety and importance, but useful contributions to knowledge in this field have nevertheless been forthcoming. An increase of adult emergence was obtained by maintaining oak or hickory infested with *Lyctus planicollis* Lec. at a moisture content of 15-18 per cent. (45 : 31). The high mortality observed among larvae of the European corn borer was found not to be caused by any nutritional deficiencies in the host tissues (46 : 262), and Loomis, Beck and Stauffer established that compounds toxic to this pest in corn are elaborated in the normal course of metabolism and at certain stages of growth are produced in concentrations high enough to be lethal (46 : 458, 47 : 12). Walter found that the silks of some inbred selections of maize were toxic to the larvae of *Heliothis zea* (Boddie), and that the character could be transmitted by breeding (46 : 101). Comprehensive tests of sorghum for resistance to the corn leaf aphid, *Rhopalosiphum maidis* (Fitch), carried out on 460 varieties, showed that a high level of resistance occurred in the Sudan sorghums; it was concluded that resistance in this crop involved both non-preference on the part of the aphid and antibiosis on the part of the host (46 : 123).

135. Preferences of the insect also play a part in determining the distribution of a population between different plant species within its natural host range. Population behaviour, or development, has been studied with particular reference to *Lymantria dispar* (L.) on different kinds of deciduous trees. It was found that the nature of the food plant affected the duration of development of the insect, and that the period for which a heavy outbreak is maintained is likewise apparently determined, at least in part, by the species of tree attacked (46 : 2). In an investigation of the food plants of *Circulifer tenellus* Baker it was found that the host species most commonly infested varied both within and between plant associations, and also differed at different times during the summer (46 : 122). The effects on fecundity of the quantity and quality of food ingested by females of *Leptinotarsa decemlineata* Say were studied in the laboratory. Fecundity was positively correlated with the quantity of food eaten, and with the age of the leaf tissue available. In further tests it was found that fecundity was positively correlated with the total choline content of the leaf (47 : 352). A study has been made of the effect of different insect hosts on the parasitoid *Bracon gelechiae* Ashm. The host was found to influence the rate of development of the parasitoid larvae, and the fecundity of females that subsequently emerged. Development and survival of parasitoid larvae in a single host species was found to be influenced by the nature of the food plant on which the host larvae had fed (46 : 12).

136. In an investigation of the effects of irrigation and application of fertiliser on three species of mirids attacking cotton, it was found that population differences between irrigated and non-irrigated plots became marked when plants in the latter began to show signs of water stress. The largest population developed on plots which had received both fertiliser and water, and the smallest on plots maintained without either (46 : 121).

137. In efforts to elucidate the factors controlling insect behaviour, constant records of activity have been made on pest species in several groups. Such studies, broadly, are still in the data-collecting stage, and conclusions are tentative. In a study of hoppers of *Nomadacris* it was considered that activities were triggered by changes in stimulation, and that the absolute levels of stimulating factors provide a background that merely limits the level of activity (47 : 201). In studies of mosquito behaviour, emphasis has been laid on recording the biting cycles of various species (B47 : 22, 79, 109, 150) and on interpreting behaviour of the adult in relation to its developmental condition.

Animal Breeding

138. *Performance testing and selection of 'gain-tested' beef cattle.* In the last three to four years, performance recording of beef bulls, previously

confined mainly to the U.S.A., has become an established practice in several other countries, though there has been some opposition to it by the breed societies in Britain. In Canada, an Advanced Registry Board issues reports of bulls tested at a central station or on the breeders' farms. Bulls are tested at the station for a period of 168 days starting at eight months old. At the end of the test they are classified on the basis of type and conformation and bulls gaining less than 2 lb./day are slaughtered. There has been no evidence of incompatibility between the type grading and rate of gain. A high correlation was found between rate and economy of gain.

One American report gives results of testing the progeny of performance-tested Hereford bulls with varying rates of gain. The rates of gain of the offspring tended to fall within the same group as that of their sire, and the heritability was estimated to be 30%.

In New Zealand similar testing of the progeny of fast and slow growing Aberdeen-Angus bulls has been begun and wide differences in the growth rate between the progeny of different bulls have been recorded. (*A.B.A.*, *27*, Nos. 148, 173; *28*, No. 455.)

139. *Progeny testing methods.* A recently introduced variant of the Relative Breeding Value or R.B.V. method of bull evaluation used in Britain is the F number now used in Sweden. This expresses the relationship between the average yield of a bull's daughters and that of all contemporary heifers in herds of similar production range, parity being expressed as 100. Correction factors are applied for the number of daughters of an A.I. bull if less than 50. In a recent paper the F number of 100 Swedish Red-and-White bulls in 1958 was given as 103·8 and for 56 Swedish Lowland (Friesian) it was 102·8 cows. (*A.B.A.*, *26*, No. 153; *28*, Nos. 131, 142.)

In Norway a method of progeny testing dairy bulls which is claimed to combine the accuracy of the field test with the advantages of the station method has been developed and is called the Hedmark system (*A.B.A.*, *27*, No. 733).

Using data from Friesian herds in England a strong within-herd correlation was obtained between 180-day and 305-day yields. On average, 66% of the 305-day yield was given in 180 days and the R.B.V.s of bulls calculated on the shorter period were in close agreement with those calculated from 305-day yields (*A.B.A.*, *27*, No. 169).

In New Zealand a new method of calculating the expected daughter average, to take into account seasonal district averages as well as the breed average, is likely to give more accurate bull evaluation (*A.B.A.*, *27*, No. 721).

140. *Influence of environment on milk production in cattle.* The value of monozygotic twins was illustrated in a long term experiment carried out in New Zealand on the relative influence of environment and genetics on milk production. Calves taken from twenty high and twenty low producing herds reared at Ruakura and then milked for one lactation gave almost exactly similar yields, whereas when members of forty sets of identical twins were divided between the two types of farm, those reared and milked in the low-producing herds gave significantly lower yields than their sisters reared in high producing herds. An analysis of the results led to the conclusion that all the differences in yield between herds are accounted for by non-genetic factors and that half the differences in fat percentage and 10% of those in fat yield were genetic. (*A.B.A.*, *28*, Nos. 455 and 1248.)

141. *Selection of adapted cattle for hot climates.* There continues to be a considerable amount of work to find suitably adapted and productive types of cattle, not only in the tropics but also for subtropical areas and in regions where established European breeds do not thrive. In the Gulf Coast region of U.S.A. comparative crosses using females of four beef types and bulls of six breeds showed that Brahman and Brangus made better mothers as judged by live weight gains to weaning than did Angus or Herefords; after weaning, steers out of the last two breeds made the best rate of gain and graded better. Steers sired by bulls of European breeds made the best gains on feed but Charollais-sired steers lacked finish. (*A.B.A.*, *27*, Nos. 667, 1248; *28*, No. 82.)

Similar work in Southern Rhodesia using imported Brahman, Santa Gertrudis, Charollais and Limousin bulls with Africander bulls on indigenous cows gave results favourable to the Charollais (*A.B.A.*, *27*, No. 81).

In South West Africa another large scale trial extending over a nine year period, using several European breeds, as well as Africander and Bonsmara, has been completed and in both calving percentage and growth rate Simmental and Brown Swiss were superior to the other breeds (*A.B.A.*, *28*, No. 86).

Work at Jeanerette, Louisiana, over a number of years has shown that the heat tolerance coefficients of beef cows have little or no predictive value. It was also found that ability to maintain normal temperature and low respiration rates is probably only one of the traits needed for good performance and therefore selection based on production would automatically include selection for heat tolerance (*A.B.A.*, *27*, No. 1261).

In so far as dairy cattle are concerned, attempts in the Southern United States to evolve an adapted type

from crosses of Red Sindhi with Jersey, Friesian and Brown Swiss have proved that although the Sindhi crosses showed an advantage in heat tolerance over Jerseys and Friesians, their milk and butterfat production was invariably lower, and the higher the amount of Sindhi blood the greater was the difference in yield between the crosses and the pure breeds, amounting in the 3/4 Sindhis to 57% less milk and 54% less butterfat. It has been concluded from this work, extending over some fourteen years, that more success is likely to be achieved by selection within European breeds for a high degree of heat tolerance combined with high production, and work will now be directed towards the possibilities of minimising physiological stress without loss of productivity (*A.B.A.*, *26*, No. 607; *28*, No. 512).

In tropical areas, where there are few European cattle, the breeding of a crossbred combining some degree of adaptation with a reasonable performance is still the aim, and a Jersey × Sindhi type called 'Jersind' is being evolved at Allahabad in North India (*A.B.A.*, *26*, No. 1177, and *27*, No. 1227).

Two studies on heat tolerance should be mentioned. One deals with the effects of environment on cattle in Indonesia (*A.B.A.*, *28*, No. 425) and describes a wide range of experiments carried out there with local cattle, imported Zebu and European cattle and various crosses. The other describes differences in the way in which fat is laid down in Zebu and European beef cattle (in Kenya). During fattening the Boran steer increases the amount of intramuscular fat whereas the European steer increases its layer of subcutaneous fat, which may tend to slow down or inhibit the dissipation of heat (*A.B.A.*, *28*, No. 511).

142. *Fifty years' progress in animal breeding in U.S.A.* A series of papers describing progress made in practically all aspects of livestock breeding in the United States was published in the *Journal of Animal Science* to mark the fiftieth anniversary of the founding of the American Society of Animal Production (*A.B.A.*, *27*, No. 599). Three papers in particular give excellent summaries of progress in beef cattle, sheep and pigs (*A.B.A.*, *27*, Nos. 667, 803 and 872). It comes as something of a surprise to learn that since 1920 there has been no positive evidence of improvement in either gaining ability or efficiency of gain of beef cattle. In pig production, however, a live weight of 200-220 lbs. is now reached about two months earlier, 1·6 more pigs are reared per litter and 80-100 lb. less feed is required per 100 lb. gain in live weight.

143. *Skin structure and physiology in relation to animal breeding.* Many recent studies in several fields of animal production have emphasised the importance of the skin of domestic livestock both to the animal breeder and the experimental scientist seeking better methods of selection or management.

Developments are most striking and obvious in relation to fleece production of sheep. In this field Australia is already the most advanced exponent of new or improved techniques. Reviews in *Animal Breeding Abstracts*, *23*, pp. 101-116 and *24*, pp. 87-118 provide some background up to 1956. Since then, however, the results of work at that time in progress or in press have been published. The general basis of much of this work has been derived from studies on the embryology and post-natal growth and differentiation of the skin specifically begun in the search for more critical characters in selection for fleece attributes among sheep. From these earlier, more academic studies not only have new experimental criteria emerged of value in physiology and genetics, but also a more precise common language between scientists in the related fields and a better means of communication between the scientist and the sheep breeder. It is now possible to clarify and rationalise the classification and measurement of sheep for genetic purposes in breeding for wool production, and to measure in precise quantitative terms the character changes achieved. The foundations are being laid for a better understanding of skin and fleece function in relation to climatic adaptation among sheep.

The same principles of systematic study of the skin are also being directed to the study of many problems in cattle breeding, again notably in Australia. Here the emphasis is mainly on skin type and function and the phenomena of hair growth more specifically in relation to climatic adaptation in the tropics. The same basic method of skin biopsy developed for the sheep has been adapted for cattle and, with certain necessary modifications in laboratory techniques, a new body of methods and criteria is now available to aid in experimental studies in the physiology and genetics of cattle adaptation.

An important by-product of these developments has been the settlement of many old misconceptions among scientists and practical breeders alike clearing the way to more profitable experiments and the application of their results. Not least has been the opening provided by the new criteria for the effective application of mathematics not only in the statistical analysis of results but in formulating theoretical concepts of physiological and genetic significance. (*A.B.A.*, *26*, No. 606; *27*, Nos. 293, 828, 1730; *28*, Nos. 506, 734.)

144. *Blood group research.* The antigenic factors of the red blood cells of farm animals have been the chief characters on which blood groups are based and many new factors have been described in cattle, sheep and pigs in recent years. Such hereditary

individual differences, however, can now be found in other constituents of blood and milk.

Two forms of adult haemoglobin have been found in sheep and cattle from India, Africa and Europe. Clear cut differences within species have also been shown in the plasma proteins of cattle, sheep, pigs and goats. The potassium concentration in the blood of some sheep is three times as high as in others and the proportion of sheep with an intermediate concentration is small.

Apart from the light which these features may throw on protein metabolism and the maintenance of electrolyte balance, they have enhanced the value of blood typing techniques in parentage registration control and twin diagnosis of cattle. They are also used as markers of the distribution and rate of spread of genes in breeding programmes.

Much attention has been given to showing that some blood types are associated with the production characters of milk yield and fat content, and with reduced fertility in cattle. Interesting findings have been made but their agricultural importance has not yet been assessed. (*A.B.A.*, *27*, Nos. 167, 727, 850, 1228, 1800; *28*, Nos. 126, 1129.)

145. *The use of ultrasonics in animal breeding.* Two separate uses of ultrasonics have recently been reported. Bull semen diluted in yolk citrate was subjected to a force of 10 W/cm² for 1½-2 minutes and this both increased motility and prolonged survival in comparison with untreated diluted semen (*A.B.A.*, *27*, No. 1838).

The measurement of backfat thickness in the live pig by ultrasonic methods has been compared with the ruler probe and lean meter methods which measure the change in resistance as the probe goes from fat to muscle. By comparison the method using ultrasonic waves at frequencies of 1·3 to 5 mc/s is easy to use and unlike the probe does not hurt the pigs. Most workers report good agreement between ultrasonic and carcass measurements and correlations with the percentage lean cuts were as high as those obtained by the probe method. In a recent British paper measurements taken on one day were within $\pm$ 13·2% of the carcass measurements taken the next day for 95% of the readings. (*A.B.A.*, *27*, No. 1922 and *28*, No. 778.)

146. *Effect of hormone administration on the quality of meat.* The use of oestrogenic hormones, either implanted or mixed with the feed, to improve growth rate and carcass quality has become widespread in several countries. The possibility that there might be residual oestrogenic activity in the meat has been the subject of a number of investigations. Other trials have compared the effects of the method of administration on meat quality. In one such trial (*A.B.A.*, *27*, No. 102) in which flavour and tenderness were compared, there was little difference in flavour between hormone-treated steers and controls, regardless of mode of administration, but meat of the controls was more tender. Steers fed on a poorer ration without any hormone, gave poorer results in both flavour and juiciness.

Other papers tend to confirm that a variety of hormone treatments has no adverse effect on the carcass quality and there is no detectable residue in the edible carcass provided that, especially in the case of lambs, there is a long enough interval between the final dose and slaughter. (*A.B.A.*, *27*, Nos. 99, 102, 1249; *26*, Nos. 241, 1397.)

While the effects of drugs and other exogenous substances—such as the antibiotics—on livestock growth are considered to be outside our sphere, we have noted an increasing interest in the administration of tranquilisers, sometimes combined with naturally occurring hormones or their synthetic substitutes. Tranquilisers have been used effectively to enhance growth rate and feed efficiency in beef cattle, while in lamb research they have provided varied and inconsistent results. Data on pigs are scanty, but it has been suggested that tranquilisers might be used to prevent fretting in early weaning. Among other potential uses for tranquilisers in livestock are the reduction of shipping shrink and shipping fever, reduction in the incidence of dark cutting beef due to excessive excitement, and increase in milk production of nervous lactating animals.

147. *Genetics and disease in sheep.* Considerable attention has been paid to two diseases in sheep which are believed to be hereditary. The first of these, scrapie, a wasting disease generally fatal, has been known for at least 200 years, but in spite of much research its cause remains obscure. Because of its incidence in Britain a ban on imports of British sheep was imposed by some countries a number of years ago, and is still in force. A recent report of a 7-year study in Britain has shown that the incidence among individuals with a close relative affected was very much higher than among those with no such connection, and the evidence points to an autosomal recessive gene. As it has also been shown that scrapie can be transmitted by inoculation, it is suggested that the lethal effects of the scrapie genotype are mediated through a self-replicating, transmissible agent, probably chemical in nature, that is formed in homozygous individuals. (*A.B.A.*, *25*, Nos. 777 and 779 and *28*, No. *1398*.)

A study has been made recently in Canada of the frequency of haemoglobin and potassium types in healthy sheep and in experimentally induced cases of scrapie. Scrapie occurred in the experimental sheep irrespective of potassium or haemoglobin type, but the numbers were too small to reflect any possible

effect on susceptibility. With progress of the disease, no changes in the blood potassium level were noted. (*A.B.A.*, *28*, No. 1392.)

Although the second disease, known as 'B' or Border disease, has been known for some ten years it was reported in the veterinary literature for the first time in 1959. It is a disease affecting the birth coat of lambs and has recently assumed substantial proportions among flocks of Kerry Hill and Clun Forest sheep. Affected lambs are generally smaller and growth rate is slower than normal, and usually their gait is defective; mortality is high. An outstanding feature is that the disease is largely confined to the progeny of ewe hoggs, though a few older ewes drop affected lambs. At present the evidence suggests a hereditary cause, though it is possible that the disease is not a simple genetic defect but is associated in some way with immaturity in the dam. (*A.B.A.*, *27*, No. 1393.)

148. *Inbreeding in sheep.* Three papers report a study of the effects of inbreeding Peppin Merino sheep in Australia (*A.B.A.*, *25*, No. 1924; *26*, No. 2000; *27*, No. 849). This study showed that inbreeding without selection was responsible for a reduction in body size, fertility, greasy and clean fleece weight, but had little influence on the fleece components. Inbred ewes took one year longer to reach peak reproductive performance and fleece weight. Because these results suggested a hormonal deficiency a group of inbred lambs was treated from birth with crude pituitary extract. Growth rate for the first ten weeks of life was increased but subsequent treatment up to 23 weeks caused no further increase. Differences in body weight and size between treated and untreated lambs were maintained long after treatment had ceased, but wool growth increased only during the period of treatment. These results suggested that the effect of inbreeding is partially derived from a reduction in pituitary activity. (*A.B.A.*, *27*, 803.)

149. *The suitability of inbred lines for laboratory use.* Until a few years ago it was generally assumed that inbred lines, because of their genetic uniformity, were more suitable than non-inbred lines for use in bioassay and biological experimentation. However, it has recently been shown that the use of inbred lines in a uniform environment does not necessarily lead to phenotypic uniformity. On the contrary, these lines are frequently more variable than the first generation crosses between two inbred lines (which are also genetically uniform) and may even be more variable than a random-bred population (*A.B.A.*, *26*, No. 2219). Particularly in their response to drugs, inbred mice have been shown to be significantly more variable than either F_1 hybrids or random-bred populations (*A.B.A.*, *25*, No. 292). Even in the case of osteometric characters, inbreeding need not lead to an appreciable reduction in phenotypic variability (*A.B.A.*, *25*, No. 2010). Besides uniformity of response, sensitivity to the drug being tested must also be taken into account. In sensitivity, the first generation hybrids are usually intermediate between the parental lines (*A.B.A.*, *28*, No. 1513), so that in this respect they are not preferable to inbred mice. The conclusion seems to be that for some experiments inbred mice are more suitable and for others hybrid mice, and that one is not invariably preferable to the other. However, F_1 hybrids are probably generally superior to inbreds in withstanding long-distance shipment and environmental changes, and they also appear to be more uniform in growth and development.

150. *Increasing fertility in livestock.* Numerous experiments have been carried out in recent years with the object of investigating the possibilities of increasing the number of offspring born as the result of a single pregnancy. This is of considerable economic importance especially when, as in some breeds of sheep, the twinning rate tends to be low, or even exceptional.

In New Zealand, in an experiment with Romneys which has been in progress for eleven years, selection for high fertility over the second five-year period resulted in the lambing percentage being 13·4% above that of the control flock and 14·8% above the flock selected for low fertility. For 6-tooth ewes it was 19% above the low fertility group. (*A.B.A.*, *27*, Nos. 1899, 1904; *28*, No. 455).

The induction of ovulation in sheep by means of hormones has a twofold purpose, namely, to bring about superovulation so that the number of lambs born is increased, or to induce ovulation during the period of anoestrus in order to produce extra-seasonal lambing, or sometimes lambing at a more favourable time of year.

In work at Cambridge (*A.B.A.*, *26*, No. 1432) in which over 2,500 ewes of nine breeds were used, injections of PMS were given at different dosage levels which resulted in an increased lambing rate, treated animals averaging 1·81 lambs/ewe *v.* 1·51 for controls. 'Litter size' was related to the level of hormone dosage, and it was observed that lamb mortality tended to increase with higher doses of PMS. Similar methods of superovulation are reported to be used extensively in Russia and some experimental work has been done in South Africa (*A.B.A.*, *28*, No. 1412, and *27*, No. 299).

In the experiments at Cambridge to breed out-of-season lambs, a conception rate of 50% was obtained following injections of progesterone and PMS. Lambs born to treated ewes did not suffer any seasonal effects, nor was the subsequent performance of the ewes adversely affected.

Studies have also been made in South Africa to overcome the low fertility common in the Merino in some areas and to select for ewes which tend to breed out of season, and in Australia the incidence and repeatability of twin ovulation in the Merino is being investigated. (*A.B.A.*, *26*, No. 866; *27*, No. 1897; *28*, Nos. 253 and 255.)

In cattle breeding the hormonal induction of twinning is currently being attempted in Britain on a field scale with the object of increasing supplies of beef calves from dairy-type cows not required to breed dairy herd replacements. The response to injections of 800 or 1000 units of PMS was directly related to the interval between injection and the onset of heat, the optimum being four days. In 37% of the cows injected, more than one ovum was shed. Egg loss was considerable and only some 25% of cows which produced two ova actually had two calves. There is evidence that response to PMS varies according to the time of year (*A.B.A.*, *27*, Nos. 576, 1250.)

151. *Transfer of ova.* Recent work in sheep on ovum transfer (*A.B.A.*, 26, No. 1430) and storage (*A.B.A.*, *27*, No. 1887) resulted in the successful transfer of ova from one ewe to another and in limited success in the birth of lambs from ova stored for short periods (less than 24 hours) in sheep serum at approximately 4° to 8°C.

A detailed account has been published of work at Minnesota on problems associated with the transfer of ova between cattle. This shows that although much progress has been made, no completely successful technique has yet been found whereby transferred ova will result in pregnancy (*A.B.A.*, *27*, No. 747).

152. *Developments in preservation and dilution of semen.* During the period under review, several potentially important methods of preservation and dilution of semen have been developed. Recognising the advantages of preservation of diluted semen at room temperature in the absence of refrigeration facilities, workers at the University of Illinois (*A.B.A.*, *25*, No. 1863) formulated a method of conservation by treating diluted semen with CO_2 and storing in sealed ampoules. The CO_2 is a reversible inhibitor of spermatozoal metabolism and its presence causes spermatozoa to become inert. On removal of the gas they again become active and can be used in A.I. This has been called the Illini variable temperature diluent and its use has been the subject of trials by several other groups of workers who, in general, have accepted it as a useful technique (*A.B.A.*, *26*, No. 1342). Experiments have shown that the conception rate for semen stored up to eight days at room temperature averaged 63·2%, but between eight and fourteen days it fell to 21·7%. Nevertheless the I.V.T. diluent has shown superiority over the ordinary egg yolk citrate diluents which in comparative trials have produced only a 40% pregnancy rate after the third day (*A.B.A.*, *27*, Nos. 792, 1343).

Large scale preservation by freezing has also been developed, especially in the U.S.A. In general it can be said that during the past three years the tendency has been to use increasingly low temperatures. For several years solid carbon dioxide was the normal refrigerant. In attempts to obtain lower temperatures, both liquid oxygen and liquid nitrogen have been used. The former is somewhat unstable and is expensive. On the other hand, liquid nitrogen, the temperature of which is −196°C, is not only inert but is a cheap and plentiful by-product of certain industrial chemical processes and its use in U.S.A., where special containers have been devised, is constantly becoming more widespread. It is now beginning to be used in Great Britain. The possible storage periods of semen have not yet been assessed, but medium-scale trials indicate that over similar storage periods freezing in nitrogen offers slightly better preservation of semen that does freezing in CO_2 (*A.B.A.*, *27*, No. 778).

153. *Artificial insemination in pigs.* Although many problems associated with the application of A.I. to the pig have been tackled, results in the field are still not satisfactory; for example, conception rates of only 30-40% have been obtained *v.* 50-60% under experimental conditions (*A.B.A.*, *25*, No. 837; *27*, No. 1472).

In 1958 in Japan, 11% of the pig population was bred by A.I. and the conception rate was claimed to be 71%. This result is difficult to reconcile with European experience but it is generally attributed to better diagnosis of oestrus in the sow, probably due to the use of vasectomised boars as teasers.

Most of the experimental work done has been on diluents and preservation, but there is no great measure of agreement on results except that it is generally agreed that the addition of antibiotics is beneficial. All types of diluents have been tried and have followed developments in cattle technique; inorganic and natural substances and mixtures of the two have been used. Induction of anabiosis by treatment with carbon dioxide has been suggested by several groups of workers, but it does not actually seem to have been tried. Freezing of semen has been tried in the U.S.A. and rather low conception figures were obtained, but the trial does not seem to have been allowed to go on to completion. In similar work in Scandinavia, no sows that had been inseminated with frozen semen farrowed. In both these cases quoted, however, only very small numbers of sows were involved and the work will doubtless continue.

As regards dilution, work in Western countries has followed conventional lines; semen from which the gelatinous portion has been removed is diluted prior to use. In one case it has been suggested that delay in adding the diluent is beneficial, three hours being allowed to elapse before dilution (*A.B.A.*, *27*, No. 371). In Russia a method has been described in which a small amount of semen is first injected into the uterus and this is followed by air and diluent, or diluent and air in that order. The dilution is thus carried out in the uterus. So far, no definite results are available (*A.B.A.*, *27*, Nos. 934 and 936).

A.I. in sheep. Much of the research on artificial insemination in sheep is being done in Russia where in 1958 a total of 29 million ewes, representing 57% of the ewe population, were inseminated. This figure compares with 12½% of the cow population. Experimental work has been concerned with improvements in the methods of semen preservation, especially at low temperatures (*A.B.A.*, *26*, Nos. 871, 873), electro-ejaculation (*A.B.A.*, *27*, Nos. 1405, 1907) and double insemination (*A.B.A.*, *26*, No. 867 and *27*, No. 1900).

In Australia a special crate has been designed in which ewes can be held in position for A.I. and set free without handling, and with only one operator (*A.B.A.*, *27*, No. 1906).

154. *The fate of spermatozoa not taking part in fertilisation.* Biologists have long been puzzled by the fact that it is necessary for so many spermatozoa to enter the female genital tract before fertilisation occurs, although normally only one spermatozoon actually enters and fertilises the egg. Various functions have been attributed to the supernumerary spermatozoa, and some biologists have suggested that they actually penetrate the uterine wall and in this way bring about a kind of 'somatic fertilisation' or at least may have important immunological consequences. Recently, several workers have tried to determine by experimental means whether or not the supernumerary spermatozoa actually do penetrate the tissues of the uterus. In general, it has been concluded that the appearance of spermatozoa in sections of uterine tissue, when it occurs, is due to an artefact (*A.B.A.*, *25*, No. 895 and *28*, No. 1688). However, one British worker (*A.B.A.*, *27*, No. 1627) has observed a flattening or indentation of the opposed surface of mucusal-cell nuclei when sperm heads lie close to them, indicating some sort of interaction, and another (*A.B.A.*, *27*, No. 2008), although finding no evidence that the sperm nuclei contribute detectable amounts of deoxyribonucleic acid to the mucosal-cell nuclei, admitted the possibility that some sperm components may enter these nuclei. The most recent view seems to be that the eventual disappearance of the supernumerary spermatozoa is due entirely to phagocytosis by leucocytes (particularly granulocytes) which invade the lumen of the uterus some hours after copulation (*A.B.A.*, *28*, Nos. 1688 and 1692.) Whether the digested sperm components have any effect on the host animal is not known.

155. *Sex control.* Recent investigations have indicated that the most promising method of sex control yet discovered is by the use of spermatozoa that have been subjected to electrophoresis. It has been found that the male-determining spermatozoa tend to migrate to the cathode and the female-determining spermatozoa to the anode. In experiments with rabbits it was confirmed that predominantly male litters were obtained from cathode-migrating sperm and predominantly female litters from anode-migrating sperm (*A.B.A.*, *25*, No. 1424 and *26*, No. 366). The method is at present only about 68% accurate, but it has been suggested (*A.B.A.*, *27*, No. 1628) that greater accuracy may be obtained by using only the first sperm to arrive at each pole, thus excluding X- and Y-bearing sperm whose isoelectric points may overlap.

Good control of sex has also been obtained by the use of spermatozoa differing in specific gravity (*A.B.A.*, *27*, No. 979). However, of 99 rabbits inseminated with spermatozoa differing in specific gravity, only 18 produced offspring. Does inseminated with specifically lighter sperm fractions produced an excess (85·7%) of male offspring, while does inseminated with specifically heavier sperm fractions produced an excess (77·3%) of females.

156. *The induction of hereditary changes by deoxyribonucleic acid.* Until fairly recently, Russian claims that the introduction of foreign substances, such as blood or egg albumen, into an organism could induce changes of a hereditary nature were not taken very seriously by most scientists in the West, but when in 1957 some French workers reported the occurrence of abnormal pigmentation in the progeny of Pekin ducks injected with Khaki Campbell deoxyribonucleic acid (DNA) (*A.B.A.*, *26*, Nos. 439 and 440, and *27*, Nos. 357 and 358) there was a great upsurge of interest in the subject and scientists from several countries were stimulated to carry out further experiments to test the possible transmissible effects of DNA, particularly as this substance is now believed to be the one primarily involved in the transmission of genetic information from one generation to the next. Negative results were found in British experiments with rats (*A.B.A.*, *27*, No. 1982) and in experiments by Czech workers on the injection of Pekin ducks and drakes with Khaki Campell DNA, but the possibility that foreign DNA may have a transmissible phenotypic effect similar to that found in bacterial transformation is now not entirely discounted and investigations are continuing.

157. *The physical bases of heredity.* Although many years have elapsed since chromosomes were first identified as the probable carriers of genetic information and the concept of the gene was established, a great deal has yet to be discovered about the nature of genetic material, its method of replication, and the means by which the coded genetic information is translated into phenotypic characters. Recent research has confirmed that deoxyribonucleic acid (DNA) is probably the most important chromosomal constituent and that it contains the genetic information (*A.B.A.*, *28*, No. 1671). There is some evidence that the molecules of DNA form a one-dimensional tape in the chromosome and that at early interphase a chromosome carries each bit of genetic information in only one of its DNA molecules (*A.B.A.*, *27*, No. 2113). Shortly before duplication, however, two sub-units of DNA are present, one of which is distributed to each daughter chromatid when duplication occurs. The two strands of the chromosome are probably structurally different and complementary to each other. The most promising model yet constructed is the duplex linear model which places the DNA molecules in linear array joined by connecting units consisting of protein (*A.B.A.*, *26*, No. 1670; *27*, No. 2149). The linear genetic information in the DNA is apparently first translated into linear information in the closely similar ribonucleic acid (RNA) molecules which control protein synthesis (*A.B.A.*, *28*, No. 1671). The picture that seems to be emerging is of chromosomes "segmented into small and apparently quite sharply distinct regions, each concerned, though almost certainly indirectly, in the formation of a particular kind of protein molecule", the specificity of each protein being determined by a single locus (*A.B.A.*, *27*, No. 2111). However, certain Russian workers have claimed that it is just as likely that the specificity of DNA is conferred on it by protein, as that the specificity of protein is induced by DNA (*A.B.A.*, *27*, No. 541).

Nutrition

158. For ease in reference both to subjects and to their classification the summary of progress is outlined according to the main sections of *Nutrition Abstracts and Reviews.*

159. *Technique.* New applications of chromatography have continued to be devised. The separation of methyl esters of straight chain monocarboxylic acids C_5-C_{14} and of dicarboxylic acids C_4-C_{11} in the gas-liquid chromatography apparatus (Abst. 4072, Vol. 26) has been described (Abst. 82, Vol. 28). Separation of complex lipids has also been achieved on columns of silicic acid (Abst. 1893, Vol. 29). An improvement in the rate of analysis of a protein hydrolysate by the use of polystyrene resins with a high degree of automation has been described (Abst. 36, Vol. 29). The estimation of fibre in animal feeds has received renewed attention (Absts. 4622-24, Vol. 28, 12-13, Vol. 29).

160. *Composition of Food.* With the expansion of laboratory services in different parts of the world analytical data for foods, many of which are local in use, continue to appear. A compilation other than ours has been prepared of the amounts of amino acids in human foods (Abst. 4820, Vol. 28) and one of values for the common constituents of concentrated by-products used in the feeding of animals (Abst. 4819, Vol. 28).

161. *Vitamins.* The link between tryptophan and nicotinic acid received practical application in the revised 1958 Recommended Dietary Allowances of the Food and Nutrition Boards, U.S. National Academy of Sciences—National Research Council (Abst. 2869, Vol. 29). Allowances are expressed as niacin equivalents and it is assumed that 60 mg. of tryptophan may be converted to 1 mg. of nicotinic acid. The riboflavin requirements of man and animals were the subject of a comprehensive and critical review (pp. 1-23, 369-386, Vol. 29). Reports continued to appear of the pharmacological actions of vitamins, *e.g.* nicotinic acid reducing blood cholesterol in animals and in man (Absts. 2080, 5031, 2816 and 5904, Vol. 28). Of thioctic acid and its relation to the nutrition of chickens it has been concluded that it should not be classed as a vitamin.

162. *Physiology of Nutrition.* In animal nutrition the particular conditions in the ruminant, especially their microbiological and enzymic aspects, have continued to receive intensive study. The ease of access to the rumen through fistulae had led to much more becoming known about digestion in that part of the system than is available about the processes in the ruminant's intestine or in the non-ruminant's digestive tract. In spite of advances in analytical techniques mentioned above there is need to overcome the disadvantages which routine methods of analysis possess for estimating apparent digestibility of lipids.

In human physiology the study of protein metabolism, in relation especially to intakes of energy as well as of protein, has remained of paramount importance for the well-being of children in under-developed countries. The effect of different types of fat in the diet on the level of cholesterol in blood has been studied in many laboratories. The idea that milk and dairy products, with their high contents of saturated fats, are dangerous to human beings may easily have damaging effects on the economy of countries where dairying is an important industry.

163. *Human Diet and Health.* In Britain the National Food Survey Committee has continued its work (Absts. 1096, Vol. 28; 1140, Vol. 29 and 2638,

Vol. 30). From the United States of America a long series of publications (Absts. 5546, Vol. 27; 1103-07, 3382, Vol. 28; 2931, Vol. 29) has dealt with food consumption in all of the States grouped in four regions. In 1957 the FAO Second Committee on Calorie Requirements issued its report (p. 1317, Vol. 27) and in the same year the Organization published its Committee's Report on Protein Requirements (p. 1351, Vol. 28). The latter proposed a pattern of essential amino acids which is desirable for human nutrition. In 1958 the Food and Nutrition Board of the National Academy of Sciences—National Research Council in the United States published the revised edition referred to above of its Recommended Dietary Allowances. Fat metabolism and intake in relation to cardiovascular disorders has been the subject of so many communications that a new section of *Nutrition Abstracts and Reviews* has had to be created for them. The subject of the estimation of the calcium requirement of man was re-assessed by Dr. Leitch in a review article (pp. 393-411, Vol. 29) in which she summarised new knowledge available since her earlier review published twenty-two years before (pp. 553-578, Vol. 6). It has been concluded in the United States that meat and offal from animals treated with oestrogens are unlikely to be dangerous to man. The hormones may be so to workers in factories where they are made.

164. *Animal Feeding*. At a conference held in Brighton in November, 1958 and organised by the *Farmer and Stock Breeder* the subject was the scientific principles of feeding of farm stock and a report was published in 1959 (p. 1456, Vol. 29). The form in which concentrates should be supplied to stock, whether as pellets or as mash, continued to receive attention. In 1959 the problem of the cause of facial eczema disease in sheep in New Zealand was solved. The discovery (Abst. 5021, Vol. 29) that a toxin from *Sporidesmium bakeri* caused liver damage in guineapigs similar to the lesions seen in lambs with the disease, had allowed the toxin to be produced much more easily than by isolation from grass. In poultry nutrition the unidentified factors supplied in practical diets by such feeds as fish and meat meals, fish solubles, dried whey and distiller's solubles, were studied (Abst. 1389, Vol. 30). A new source of animal protein for use in broiler rations was fishmeal prepared from 'croaker' fish (*Micropogon undulatus*).

Forestry

165. In a field so wide as forestry's, a representative picture of progress cannot be given in small compass, only samples from a few selected subjects. Those touched on here, it may be noted, are quite different from those reported on three years ago.

166. *Insect pests*. The house longhorn beetle, *Hylotrupes bajulus*, an essentially 'domestic' pest of coniferous timber, appears to be spreading in Great Britain, where White has recently reassessed its status (*F.A.* 21, No. 2479), noting also its arrival in Jersey via *Pinus pinaster* floorboards and other timber imported from France (*F.A.* 20, No. 3863). First reports of its occurrence have also come from Australia (*F.A.* 19, No. 1102). With the continued spread of this destructive household pest, investigations into its biology, and especially the bionomics of its larvae, have been numerous. In West Germany, breeding studies carried out over a period of some 10 years showed that egg-laying was increased when fertilized females were exposed to ultra-violet rays (Osram ultravitalex lamp), that cold treatment was necessary to induce pupation, and that the mechanical stimulus of rough wood surfaces, rather than smell, seemed to be the determining factor for egg-laying (*F.A.* 20, No. 2510). In other German studies concentrating on the development and behaviour of larvae under ordinary household conditions, it was found that Spruce sapwood was more nourishing than Pine, that weight loss in larvae was often, but not always, associated with pupation, and that larvae took from $1\frac{3}{4}$ to more than 3 years to develop; the data also indicated that, out of an original population of 100 young larvae, each weighing 13-26 mg., not more than 16 would attain a weight of 400 mg., the others pupating at lower weights or dying, and their total consumption of wood would be ca. 4,000 c.c. (*F.A.* 21, No. 2480). Continued work in England on the relation of wood moisture content to larval development has shown that larvae introduced to Scots Pine sapwood conditioned to 10% moisture content at 25°C do not develop, whereas in wood of ca. 27% moisture content and same temperature, they grew in weight in 43 weeks to more than 400 mg. (*F.A.* 20, No. 1171). From Denmark proposals have come for complex statistical designs for the simultaneous analysis of several larval growth factors (*F.A.* 19, No. 2452).

French work, in laboratory and field, on what attracts Scolytid beetles to particular tree species or individuals has shown that α-pinene, β-pinene, and terpineol, while repellent at high concentrations, are definitely attractive in dilute ones, separately or together, while other chemical constituents are repellent or neutral. At the same time, low osmotic pressures, in wood, bark or needles, were found to invite heavy attack, but in different degrees by different species (*F.A.* 21, Nos. 755-7).

167. *Butt-rot*. Continued attention is being paid to the biology of *Fomes annosus*, the principal cause of butt-rot in conifers over much of the world. A recent study in western Jutland showed a peak of

infection in plantations there in the 50- to 59-year class, where an average of 41% of trees was infected (*F.A.* 19, No. 1943) and mortality associated with its attack has again been reported from the U.S.A., where 10% of trees in a stand of *Pinus echinata* died four years after thinning. Among numerous investigations directed to discovering effective measures of control, those of Rishbeth (*F.A.* 18, No. 4225; 20, No. 708; 21, No. 632) have demonstrated the frequency of stump infection after thinning and the wide distribution of spores, comparing the latter with the spore distribution of *Peniophora gigantea*, a common saprophyte that competes actively with *Fomes* for sites of colonization, e.g. on the cut surfaces of stumps. Molin, in Sweden, has further demonstrated that the spores of *F. annosus* can pass down through 20 to 40 cm. of soil and germinate on wood beneath. Other workers are concerned with the influence of soil cultivation (*F.A.* 20, No. 712), of fertilizing (*F.A.* 20, No. 490) or of soil water (*F.A.* 20, No. 54) on the spread of infection. Recent studies indicate that soil water may be inhibitory.

168. *Fungal antagonism.* The observation that fumigation with CS_2 of soil containing roots infected by *Armillaria mellea* results not only in a notable increase of the fungus *Trichoderma viride* (which is highly CS_2-tolerant) but its invasion of the infected and fumigated roots, has led to studies demonstrating the lethal action of *T. viride* on *A. mellea.* Incubation of inoculum segments for 23 days in a pure culture of *T. viride* grown on autoclave-sterilized soil resulted in a 95% kill of *A. mellea*, dilution of the pure culture to $\frac{1}{4}$ and $\frac{1}{8}$ strengths with unsterilized soil causing a progressive reduction in its lethal effect.

169. *Control of mistletoe.* Since the early post-war experiments in Australia, increasing study has been devoted there to the technique and economics of using the chemical 2,4-D for the control of this widespread pest, notably by introducing it into the stem instead of by spraying (cf. *F.A.* 17, No. 551 and preceding papers). One large-scale trial (*F.A.* 19, No. 1919), introducing 2,4-D into axe-cuts round the stem, successfully treated 700 infected trees of 18 in. mean diameter, on an area of 50 acres, at a cost of less than 6*d.* per tree. Other recent trials, in which the 2,4-D was introduced into bore holes in the stems of eight species of Eucalypts (*F.A.* 20, No. 3322), resulted in some partial and temporary defoliation and the death of some 5% of the host trees, but also secured a 70-100% kill of the mistletoe (*Loranthus* species, and particularly *Amyema pendula*). A second injection two years later killed about 50% of the mistletoe surviving and with seven of the species satisfactory control was claimed at an economic cost—though this claim has been challenged (*F.A.* 21, No. 3339).

170. *Wood anatomy.* A new and promising method of measuring the amount and distribution of cell-wall material from transverse microscopic sections of wood has been devised by a researcher in England. The image of the transverse section is projected on to a card (the sampling field) which is pierced by 100 minute pin-holes distributed at random. These, when illuminated from below, give 100 clearly visible sampling points on the projected image, and the proportion of such points falling on cell-walls gives the percentage of cell-wall material in the area sampled. The method is fast, easy to use and probably more accurate than direct measurement. The diameters and cross-sectional areas of cells can easily be obtained at the same time (*F.A.* 21, No. 3665).

171. *Properties of wood.* Radio-active isotopes are being used as a radiation source in wood research on two distinct problems: (*a*) the effects of radiation on the wood itself; and (*b*) applications in testing the properties of wood.

Work at Princes Risborough has shown that the hygroscopicity of wood, and perhaps other physical properties, are affected only by very heavy doses of radiation. With gamma rays the effect is negligible at doses below 10 million rad (*F.A.* 19, No. 2279; 20, No. 966). In applications to testing, it has been shown that measurements of gamma-ray absorption can be made with sufficient sensitivity to detect ½-inch spaces in a pile of 24 boards, and this method was also successfully applied to the detection of defects in logs (*F.A.* 21, No. 944). In Japanese work, a similar method has shown promise for revealing heart rot and its extent in standing trees: at temperatures exceeding 0°C unsound trees were detected with 100% success (*F.A.* 19, No. 3152). Another application, with satisfactory results, has been the determination of moisture content: in Japan the distribution of moisture in thick disks of wood was traced; and in Germany moisture changes in a young, growing tree (*F.A.* 19, No. 3407; 21, No. 2306). Russian workers have studied the absorption of beta-rays in relation to thickness, density and moisture content of various woods; they consider beta-rays more suitable than gamma-rays for density and moisture measurements (*F.A.* 20, No. 2282). In the United Kingdom, a semi-micro method, using beta-rays, has been devised for determining density (*F.A.* 20, No. 984). It has been applied with success to trace density variations within individual growth rings of an increment core —a task that is both tedious and difficult by the ordinary gravimetric technique (*F.A.* 21, No. 959).

Soil Science

172. *Soil Biology.* There has been a marked increase in interest in biological aspects of soil science, as evidenced by an increase of 24% in the

number of papers published on soil biology in the past three years, compared with the previous three years. The greatest development, at least as shown by the number of papers published, has been in the Soviet Union where, among other matters, much attention has been paid to the effects of cultivation on the soil microflora.

173. *Effect of Cultivation.* The effect of cultivation under most conditions is to increase the microbial population, leading to a loss of humus and nitrogen unless manure is applied. In general, the effect of adding fertilizers is to increase the numbers of microbes. The effect is greatest with organic fertilizers, but is evident also with inorganic fertilizers. In Latvia it was found that the arable and deeper horizons of soils receiving a fair degree of cultivation contained twice as many bacteria and three times as many spores and actinomycetes as soils given scant cultivation. Numbers of fungi, however, were lower in well cultivated soils. The use of a mouldboard plough increased bacterial numbers more than did disking or other cultivations which do not turn the soil over, and deep cultivation (with inversion of the soil) more than shallow cultivation. In Canada, however, clean cultivation of an orchard soil had little effect on microbial numbers (*S. & F.* XX, 1321; XXI, 1388, 1753; XXII, 661, 662, 2760).

174. *Nitrogen Fixation.* The question of where all the nitrogen in soils comes from continues to pose many problems. In the case of temperate-climate soils it is usually assumed that the main entry of nitrogen into the soil is by fixation from the atmosphere by bacteria living symbiotically on legume roots. In tropical climates, however, both cultivated and natural legumes are comparatively rare, and as far as is known symbiotic nitrogen fixation is less than in temperate climates. Norris (*S. & F.* XXIII, 195), however, has pointed out that the Leguminosae are primarily a tropical family, but that nearly all the studies on nodule bacteria have been made on recently evolved adaptations, particularly *Trifolieae* and *Viciae*, to temperate climates. He associates the observed low nitrogen fixation in the tropics with the high soil-nitrate content commonly found at the onset of the rainy season that is known to inhibit nodulation. Bonnier and Seeger (*S. & F.*, XXII, 1167) state that in tropical forests, where all vegetation is returned to the soil and the soil nitrogen content is in equilibrium, nodulation of legumes is rare, but under cultivation, where nitrogen is removed in the crop, nodulation and nitrogen fixation can be brought about by inoculation with appropriate strains of *Rhizobium*. The difficulty is to find effective strains, but two forms were isolated from various tropical legumes, one of which always gave positive results.

Reisenauer (*S. & F.* XXIII, 1689) describes experiments growing lucerne in purified culture solutions with and without addition of cobalt, that showed that cobalt had a very pronounced effect on the amount of nitrogen symbiotically fixed, and on the amount of vegetable matter produced by the lucerne. It is known that cobalt is essential for the synthesis of vitamin B_{12} by micro-organisms, and that the vitamin is required by animals to form haemoglobin which is also found in legume root nodules.

175. *Bacterial Fertilizers.* In the Soviet Union inoculation with the free-living nitrogen-fixing bacterium *Azotobacter* has become standard farm practice, though the practice has seldom been found effective elsewhere as a means of increasing yields. Use of another inoculant 'phosphobacterin' (a preparation of *Bacillus megatherium* var. *phosphaticum*) is also widespread (*S. & F.* XXII, p. 327). The *Azotobacter* inoculant ('azotobacterin') is said to have benefited more than half the crops to which it has been applied and to have produced average yield increases of the order of 10 per cent. Phosphobacterin has been about equally effective, especially on soils containing much organically bound phosphorus. Although it was originally thought that these inoculants acted by fixing nitrogen and releasing phosphorus, respectively, scientific opinion is coming to believe that the effects are more complex. For example, inoculation with *Azotobacter* often markedly increases the effect of both organic and inorganic manures, and there is some evidence that *Azotobacter* stimulates the production of growth-promoting substances such as indoleacetic acid, besides destroying soil toxins produced by other micro-organisms (*S. & F.* XXI, 1034). Many other bacterial fertilizers have been used in the Soviet Union with varying success, but much of the work appears to be of a somewhat empirical nature. There is no question, however, that the use of bacterial fertilizers has now become an established feature of Russian agriculture, and that a large industry has grown up for their production (*S. & F.* XXI, 1410; XXII, 237, 701, 2790).

176. *Non-bacterial Nitrogen Fixation.* Experiments with N^{15} in New Zealand suggest that nitrogen fixation is a commoner process in the growth of plants than is usually assumed, and may take place in leafy shoots as well as roots (*S. & F.* XXIII, 1691). Mycorrhiza may be involved, for seedlings of *Pinus radiata* with mycorrhiza grew successfully in nitrogen-free media, and non-mycorrhizal seedlings died. Perennial rye-grass, wheat and uninoculated clover were successfully grown in nitrogen-free sand cultures in which growth of nitrogen-fixing organisms was prevented. Several plants, when exposed to a N^{15}-enriched atmosphere absorbed N^{15} into their tissues. It is

thought that nitrogen fixation is of general occurrence in the foliage of trees, shrubs and weeds. If these observations were confirmed and extended, one of the major problems of soil science and plant nutrition would be approaching solution.

177. *Macrofauna.* Increasing attention is also being paid to the role of the macro- and mesofauna, as distinct from the microflora, in the formation of humus, particularly of forest soils. It has been shown that a large part of the humic material on the surface of forest soils consists of the excrement of animals and insects. It has been known for long that earthworms are the main agents which mix and combine organic and mineral matter and excrete it into the soil as the 'organo-mineral complex', but it is now recognised that many other members of the soil fauna have a similar action. Although the evidence indicates that the actual formation of humus is done mainly by micro-organisms the soil fauna has to macerate and comminute the plant material before much humification can occur (*S. & F.* XXI, 213). Dunger (*S. & F.* XXI, 1798; XXII, 206) made a detailed study of the humic matter in the excrement of diplopods and isopods feeding on fresh and fallen leaves, and showed that the chemical composition of fallen leaves undergoes little change during passage through the gut; there is no enrichment in nitrogen in the excrements, but there is a slight increase in the humus from leaves rich in nitrogen. Micro-organisms attack well decomposed much more than slightly decomposed excrements. It was estimated that diplopods and isopods between them consumed one third of the annual litter fall of a moist ash-oak forest, the diplopods consuming at least twice as much as the isopods. Snails have been shown to be active consumers of fallen leaves (*S. & F.* XXI, 214, 2247).

Gilbert and Bocock (*S. & F.* XXIII, 1667, 1668) observed a largely unexplained increase in the nitrogen content of decomposing ash litter in a forest with moder humus, whereas the nitrogen content on more fertile mull humus declined. With oak litter there was a large increase on moder, and a much smaller increase on mull.

FINANCE

178. The Comptroller and Auditor-General has audited the accounts of the Bureaux, the Institute of Entomology, and the Mycological Institute for 1959-60 and the account of the Institute of Biological Control for 1958-59. These accounts are attached to this report. The position as regards contributions on 31st March, 1960, was as follows:

(1)	Contributions due in 1959–60 (2)	Outstanding on 31.3.59 (3)	Total due (4)	Outstanding on 31.3.60 (5)	Total received in 1959–60 (6)
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
The Bureaux	163,314 0 0	886 2 4	164,200 2 4	2,904 12 4	161,295 10 0
Institute of Entomology	47,475 0 0	258 5 0	47,733 5 0	844 5 0	46,889 0 0
Mycological Institute	41,778 0 0	226 16 0	42,004 16 0	742 5 0	41,262 11 0

NOTES:

(i) The figures in column (2) are those recommended by the Review Conference 1955 (page 48 of the report).

(ii) The figure of receipts in column (6) in respect of the Bureaux Fund is less than the figure shown in the audited account on page 43 by £152 0*s.* 0*d.* This is because of an advance payment from the Colonial Territories for 1960-61. The figures for Entomology and Mycology are less than the figures shown in the audited accounts on pages 44-45 by £5 6*s.* 0*d.* and £4 13*s.* 0*d.* respectively. These amounts were received from the Colonial Territories during 1958/59 for that year but were not credited to the Institutes until 1959/60.

(iii) An amount of £6,028 13*s.* 5*d.* reported in note (iii) on page 38 of the 24th Annual Report is still outstanding.

(iv) An amount of £915 5*s.* 0*d.* reported in note (iii) on page 36 of the 29th Annual Report is still outstanding.

(v) The outstandings in column (5) are from Pakistan £4,389 and the Colonial Territories £102 2*s.* 4*d.*

179. *Commonwealth Institute of Biological Control.* The audited account for the Institute of Biological Control attached to this report relates to the year 1958-59. The position as regards contributions from Governments at 31st March, 1959, was as follows:

	£	s.	d.
Amount due in respect of 1958/59 ..	43,044	0	0
Add arrears outstanding on 31st March, 1958	377	3	0
Amount expected in 1958/59	43,421	3	0
Deduct arrears outstanding on 31st March, 1959	233	15	0
Contributions received during the year	£43,187	8	0

The outstanding amount on 31st March, 1959 has been paid.

Note:

(i) An amount of £668 8*s*. 2*d*. reported in note (ii) on page 45 of the 25th Annual Report is still outstanding.

(ii) An amount of £39 15*s*. 0*d*. reported in note (ii) on page 38 of the 30th Annual Report is still outstanding.

(iii) The figure in the audited account on page 46 is less than the amount shown above by £4 16s. 0d. The amount was received from the Colonial Territories during 1958/59 but was not credited until after the close of the financial year.

180. The total expenditure between the Bureaux, Secretariat and Central Sales is given below:

Commonwealth Bureaux:	£	s.	d.
Animal Breeding and Genetics (Edinburgh)	18,732	15	4
Animal Health (Weybridge)	23,129	14	1
Animal Nutrition (Aberdeen)	16,775	16	4*
Dairy Science and Technology (Shinfield)	17,065	0	11
Forestry (Oxford)	21,465	6	1
Helminthology (St. Albans)	17,954	13	2
Horticulture and Plantation Crops (East Malling)	20,881	15	3
Pastures and Field Crops (Hurley) ..	22,981	19	4
Plant Breeding and Genetics (Cambridge)	18,388	8	5
Soils (Rothamsted)	18,261	2	5
Secretariat	18,982	19	5
Central Sales Branch	14,845	17	11
Contribution to National Institute of Agricultural Engineering (Silsoe) ..	3,000	0	0
Contribution to World Agricultural Economics and Rural Sociology Abstracts	1,000	0	0
	£233,465	8	8

*To make the expenditure of the Bureau of Animal Nutrition comparable with all the other figures, a sum of £11,812 5*s*. 0*d*. should be added to £16,775 16*s*. 4*d*. making £28,588 1*s*. 4*d*. This amount of £11,812 5*s*. 0*d*. is taken from the separate audited account for *Nutrition Abstracts and Reviews* and is the total of printing, distribution, administration and extra staff costs. These costs are included in the totals for other bureaux shown in the above table.

THE EXECUTIVE COUNCIL OF THE COMMONWEALTH AGRICULTURAL BUREAUX

Account of Receipts and Payments for the Year ended 31st March, 1960

RECEIPTS

	£ s. d.	£ s. d.
Contributions from Commonwealth and other participating Governments for:		
Commonwealth Agricultural Bureaux ..	161,447 10 0	
Various Institutes	123,807 5 0	
	285,254 15 0	
Less: paid over to Institutes	123,807 5 0	
		161,447 10 0
Sale of publications		50,966 18 3
Reprinting for Institutes, etc.		1,543 5 2
Contributions from Institutes towards cost of Headquarters		3,000 0 0
Miscellaneous receipts:		
Dividends and Interest	6,734 18 6	
Other receipts	416 2 3	
		7,151 0 9
		224,108 14 2
Balance at 1st April, 1959		43,653 14 7
		£267,762 8 9

PAYMENTS

	£ s. d.	£ s. d.
Secretary's and Assistant Secretary's Salaries ..		4,922 10 0
Consultant Directors' honoraria		945 0 0
Directors' and Assistant Directors' Salaries ..		40,962 17 5
Scientific Assistants' Salaries		54,432 1 6
Clerical and Technical Staff		47,303 18 6
National Insurance		2,877 10 7
Superannuation		12,206 17 5
Supplementation of Superannuation and increases in pensions		1,038 19 3
Travelling expenses		1,825 15 1
Books, periodicals, etc.		2,451 11 10
Issue bulletins and periodicals publications ..		41,223 3 3
Stationery, postage, telephones, etc.		6,612 9 1
Rent, Maintenance, etc.		5,279 9 1
Contribution to National Institute of Agricultural Engineering		3,000 0 0
Grant to World Agricultural Economics and Rural Sociology Abstracts		1,000 0 0
Accounting charges and Audit Fee		2,110 0 0
Miscellaneous Expenses		983 3 6
Furniture and equipment		3,678 6 1
Visits Overseas (outside Europe)		540 9 1
Review Conference		71 7 0
		233,465 8 8
Balances at 31st March, 1960:		
H.M. Paymaster General	17,179 15 3	
Post Office Savings Bank	4,694 10 3	
Treasury Bills—at cost	9,904 11 8	
Sub-accountants and suspense	2,518 2 11	
		34,297 0 1
		£267,762 8 9

Investments at 31st March, 1960:

£		*Cost* £ s. d.	*Market value at 31st March, 1960* £ s. d.
2,000	Commonwealth of Australia 4% Stock, 1955-70	1,940 4 0	1,760 0 0
	Cheshire County Council loans:		
25,000	to 25th April, 1960 at 6%	25,000 0 0	25,000 0 0
25,000	to 4th June, 1960 at 5¾%	25,000 0 0	25,000 0 0
	Slough Borough Council loans:		
17,000	to 23rd September, 1960 at 5½% ..	17,000 0 0	17,000 0 0
15,000	to 27th January, 1961 at 5½%	15,000 0 0	15,000 0 0
20,000	to 18th March, 1961 at 5¼%	20,000 0 0	20,000 0 0
		£103,940 4 0	£103,760 0 0

(Signed) F. H. DAVEY,
Accountant to Council.

(Signed) S. HOWARD, Secretary,
Executive Council, Commonwealth
Agricultural Bureaux.

I have examined the above Account. I have obtained all the information and explanations that I have required, and I certify, as the result of my audit, that in my opinion the above account is correct.

Exchequer and Audit Department,
29th June, 1960.

(Signed) E. G. COMPTON,
Comptroller and Auditor-General.

COMMONWEALTH INSTITUTE OF ENTOMOLOGY

ACCOUNT OF RECEIPTS AND PAYMENTS FOR THE YEAR ENDED 31ST MARCH, 1960

RECEIPTS

	£	s.	d.	£	s.	d.
Contributions:						
Commonwealth and other participating Governments	46,894	6	0			
Other contributors ..	500	0	0			
				47,394	6	0
Sale of publications				14,800	18	2
Dividends and interest ..				1,487	11	4
Refund of income tax (Schedule 'A' for 1958/59)				72	17	0
Administration Fees and Agency charges:						
Pool of Entomologists ..	200	0	0			
Termite Research Unit ..	75	0	0			
African Phyto-sanitary Commission	1,750	0	0			
				2,025	0	0
				65,780	12	6
Redemption of Securities:						
£2,000 War Loan 3% Stock, 1955/59				2,000	0	0
Balance at 1st April, 1959 ..				17,337	14	9
				£85,118	7	3

PAYMENTS

	£	s.	d.	£	s.	d.
Directors' salaries				5,283	6	8
Scientific Assistants' salaries				28,729	9	7
Clerical and Technical staff				10,776	14	11
National Insurance				864	14	10
Superannuation				4,217	1	8
Supplementation of superannuation and increases in pensions				952	12	5
Travelling expenses				30	19	9
Books, periodicals, etc.				377	3	3
Issue bulletins and periodical publications				8,888	16	8
Stationery, postage, telephones, etc.				847	14	6
Rates, insurance, maintenance, etc.				396	10	5
Lighting, heating, water, cleaning, etc.				522	17	4
Contribution to Headquarters, accounting charges and audit fee				1,504	2	7
Miscellaneous Expenses				137	19	9
Furniture and Equipment				463	5	7
				63,993	9	11
Loans:						
Doncaster Corporation				5,000	0	0
Balances at 31st March, 1960:						
Crown Agents for Oversea Governments and Administrations	948	10	6			
Bank, petty cash and stamps	31	10	1			
Joint Consolidated Fund	14,000	0	0			
F.S.S.U. and miscellaneous suspense	1,144	16	9			
				16,124	17	4
				£85,118	7	3

Investments at 31st March, 1960:

£	s.	d.		Cost £	s.	d.	*Market value at 31st March, 1960* £	s.	d.
1,000	0	0	Cyprus 4% Stock, 1956/66	950	0	0	830	0	0
2,679	19	0	Funding Loan 4% Stock, 1960/90 ..	1,869	12	6	2,425	7	1
1,017	16	8	Kenya 4½% Stock, 1961/71	998	15	0	834	12	6
1,000	0	0	Nigeria 4% Stock, 1963	881	7	0	915	0	0
951	1	10	Savings 3% Bonds, 1960/70	1,040	5	2	760	17	6
3,000	0	0	N. Rhodesia 3% Stock, 1963/65	2,911	1	7	2,460	0	0
2,060	17	1	Savings 3% Bonds, 1955/65	2,126	15	1	1,865	1	6
1,013	18	2	Nyasaland 4½% Stock, 1971/78	1,000	13	3	785	15	7
5,000	0	0	Doncaster Corporation loan: to 31st March, 1961, at 5½%	5,000	0	0	5,000	0	0
				£16,778	9	7	£15,876	14	2

(Signed) F. H. DAVEY,
Accountant to Council.

(Signed) S. HOWARD, Secretary,
Executive Council,
Commonwealth Agricultural Bureaux.

I have examined the above Account. I have obtained all the information and explanations that I have required, and I certify, as the result of my audit, that in my opinion the above account is correct.

(Signed) E. G. COMPTON,
Comptroller and Auditor-General.

Exchequer and Audit Department,
29th June, 1960.

(Signed) E. O. PEARSON,
Director.

COMMONWEALTH MYCOLOGICAL INSTITUTE

Account of Receipts and Payments for the Year ended 31st March, 1960

RECEIPTS

	£ s. d.	£ s. d.
Contributions:		
Commonwealth and other participating Governments	41,267 4 0	
Other contributors ..	2,527 12 9	
		43,794 16 9
Sale of publications		11,770 5 10
Sale of Cultures		747 4 10
Rent of acquired property ..		1,200 10 2
Dividends and Interest ..		1,335 15 0
Administration Fees and Agency charges:		
Pool of Plant Pathologists	872 15 3	
African Phyto-sanitary Commission	2,573 1 3	
		3,445 16 6
		62,294 9 1
Instalment of contribution towards cost of building completed in 1955 ..		51 0 0
Balance at 1st April, 1959 ..		33,347 2 2
		£95,692 11 3

PAYMENTS

	£ s. d.	£ s. d.
Director's Salary		2,825 0 0
Scientific Assistants' Salaries		25,246 5 10
Clerical and Technical staff		14,486 7 2
National Insurance		915 14 6
Superannuation		3,889 10 1
Supplementation of Superannuation and Increases in pensions		231 10 1
Travelling expenses		136 4 11
Books, periodicals, etc.		418 13 11
Issue bulletins and periodical publications		7,248 18 0
Stationery, postage, telephones, etc.		773 14 9
Rent, rates, insurance, maintenance, etc.		1,636 3 10
Lighting, heating, water, cleaning, etc.		2,604 9 5
Contribution to Headquarters, accounting charges and audit fee		1,455 13 3
Miscellaneous expenses		129 13 9
Furniture and equipment		1,801 6 2
Visits Overseas (outside Europe)		315 17 3
		64,115 2 11
Loans:		
Slough Borough Council		15,000 0 0
Balances at 31st March, 1960:		
Crown Agents for Oversea Governments and Administrations	172 1 1	
Bank, petty cash and stamps	452 18 11	
Joint Consolidated Fund	15,000 0 0	
F.S.S.U. and Miscellaneous Suspense	952 8 4	
		16,577 8 4
		£95,692 11 3

(Signed) F. H. DAVEY,
Accountant to Council.

(Signed) S. HOWARD, Secretary,
Executive Council,
Commonwealth Agricultural Bureaux.

I have examined the above Account. I have obtained all the information and explanations that I have required, and I certify, as the result of my audit, that in my opinion the above account is correct.

(Signed) E. G. COMPTON,
Comptroller and Auditor-General.

Exchequer and Audit Department.
29th June, 1960.

Investments at 31st March, 1960:

£ s. d.		Cost £ s. d.	*Market value at 31st March, 1960* £ s. d.
2,077 15 4	New Zealand 3½% Stock, 1960/64	2,077 15 4	1,963 9 9
15,000 0 0	Slough Borough Council loan: to 15th May 1961 at 5½%	15,000 0 0	15,000 0 0
		17,077 15 4	16,963 9 9

(Signed) J. C. HOPKINS,
Director.

COMMONWEALTH INSTITUTE OF BIOLOGICAL CONTROL

ACCOUNT OF RECEIPTS AND PAYMENTS FOR THE YEAR ENDED 31ST MARCH, 1959

RECEIPTS	Canada $ c.	Canada £ s. d.	United Kingdom £ s. d.	Total £ s. d.
Contributions from Commonwealth and other Governments	19,141.56	7,072 0 0	36,110 12 0	43,182 12 0
Sale of publications ..	516.18	190 3 10	37 11 0	227 14 10
Interest:				
General account ..			815 1 9	815 1 9
Capital account ..			244 4 9	244 4 9
Income from levy on special projects:				
(*a*) Overheads $4,890.10				
(*b*) Use of official cars $6,622.71				
	11,512.81	4,242 0 2		4,242 0 2
Miscellaneous receipts ..	1,877.29	691 14 1		691 14 1
	33,047.84	12,195 18 1	37,207 9 6	49,403 7 7
Remittances from the United Kingdom ..	81,212.50	30,000 0 0		30,000 0 0
Special projects:				
Receipts from sponsors $39,191.69				
Less: allocated above $11,512.81				
	27,678.88	10,198 11 1		10,198 11 1
Redemption of Securities:				
£7,000 Conversion Loan 4% Stock 1957-58			7,000 0 0	7,000 0 0

PAYMENTS	Canada $ c.	Canada £ s. d.	United Kingdom £ s. d.	Total £ s. d.
Directors' Salaries	20,994.96	7,735 16 0	409 5 4	8,145 1 4
Superannuation			727 4 9	727 4 9
Entomologists' Salaries ..	45,220.39	16,661 17 11	976 15 2	17,638 13 1
Superannuation.. ..			1,927 0 10	1,927 0 10
Clerical and Technical Staff Salaries	15,795.22	5,819 18 1	192 17 5	6,012 15 6
Superannuation			303 13 3	303 13 3
Travelling expenses.. ..	5,525.18	2,035 16 2	50 14 6	2,086 10 8
Official cars: running expenses	6,484.99	2,389 9 2		2,389 9 2
Books, periodicals, etc. ..	884.27	325 16 4		325 16 4
Issue bulletins and periodical publications	1,016.66	374 12 0	343 1 2	717 13 2
Freight and Postage ..	3,200.56	1,179 5 7		1,179 5 7
Rent, Maintenance, etc.:				
Headquarters, Ottawa ..	193.65	71 7 1		71 7 1
Field Stations	5,800.96	2,137 8 5		2,137 8 5
Contribution to Headquarters, accounting charges and audit fee			1,050 7 2	1,050 7 2
Miscellaneous expenses ..	68.50	25 4 9	33 6 8	58 11 5
Furniture and Equipment ..	5,607.38	2,066 1 11		2,066 1 11
	110,792.72	40,822 13 5	6,014 6 3	46,836 19 8
Remittances to Canada ..			30,000 0 0	30,000 0 0
Exchange difference on revaluation of dollar balances at 31st March, 1959 ..		34 18 1		34 18 1
Expenditure on special projects	28,366.50	10,451 18 4		10,451 18 4

Balance at 1st April, 1958	25,494.94	9,291	3	2	14,049	6	5	23,340	9	7
	$167,434.16	£61,685	12	4	£58,256	15	11	£119,942	8	3

(Signed) F. H. DAVEY,
Accountant to Council.

(Signed) F. J. SIMMONDS,
Director.

I have examined the above Account. I have obtained all the information and explanations that I have required, and I certify, as the result of my audit, that in my opinion the above account is correct.

(Signed) E. G. COMPTON,
Comptroller and Auditor-General.

Exchequer and Audit Department,
28th April, 1960.

Balances at 31st March, 1959:										
United Kingdom:	£	s.	d.							
Crown Agents for Oversea Governments and Administrations	727	12	7							
Joint Consolidated Fund	13,000	0	0							
Post Office Savings Bank (capital account)	439	11	0							
F.S.S.U. Suspense	3	6	1							
Miscellaneous Suspense ...	72	0	0							
							14,242	9	8	14,242 9 8
Canada:	$	c.								
Sundry Imprests	14,095.31									
Treasury	14,179.63									
				28,274.94	10,376	2	6			10,376 2 6
				$167,434.16	£61,685	12	4	£58,256	15	11 £119,942 8 3

Investments at 31st March, 1959:	*Cost*	*Market value at 31st March, 1959*
£8,000 Slough Borough Council loan: to 23rd September 1960 @ 5½%	£8,000	£8,000

NOTE: The closing balance in Canada shown above includes an unexpended balance of $10,477.70 of advances received from sponsors of special projects: expenditure on other projects not yet recovered amounts to $12,525.04.

(Signed) S. HOWARD, Secretary, Executive Council,
Commonwealth Agricultural Bureaux.

LIST OF SANCTIONED STAFF, BY GRADES
TEN BUREAUX, HEADQUARTERS AND CENTRAL SALES

Secretary	*Assistant Secretary*	*Directors*	*Assistant Directors*	*Scientific Assistants*	*Executive Assistants*	*Indexers*	*Senior Clerical*	*Clerical and Typing*
1 (1)	1 (1)	10 (10)	10 (10)	56½ (55)	3 (—)	9¼ (9)	11 (15)	61½ (60)

INSTITUTES

	Director	*Assistant Director*	*Scientists*		*Executive Assistant*	*Preparators, etc.*		
			A/B	*C*		*D*	*E*	*F/Clerical and Typing*
Entomology	1 (1)	1 (1)	14 (15)	11 (13)	—	7 (9)	3 (3)	7 (7)
Mycology	1 (1)	—	12 (13½)	8 (10)	1 (—)	2 (1)	10 (10)	12 (19)

	Director	*Assistant Director*	*Senior Entomologist*	*Scientists*			*Librarian*	*Clerical and Typing*
				A	*B*	*C*		
Biological Control ..	1 (1)	— (1)	1 (1)	1 (5)	2 (2)	6 (5)	1 (1)	10 (3)

Figures in brackets are those recommended by the 1955 Review Conference, see page 50 of the Report. This staff was not necessarily to be worked up to at the beginning of the quinquennium.

Consultant Directors are not included.

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